



TRANE®

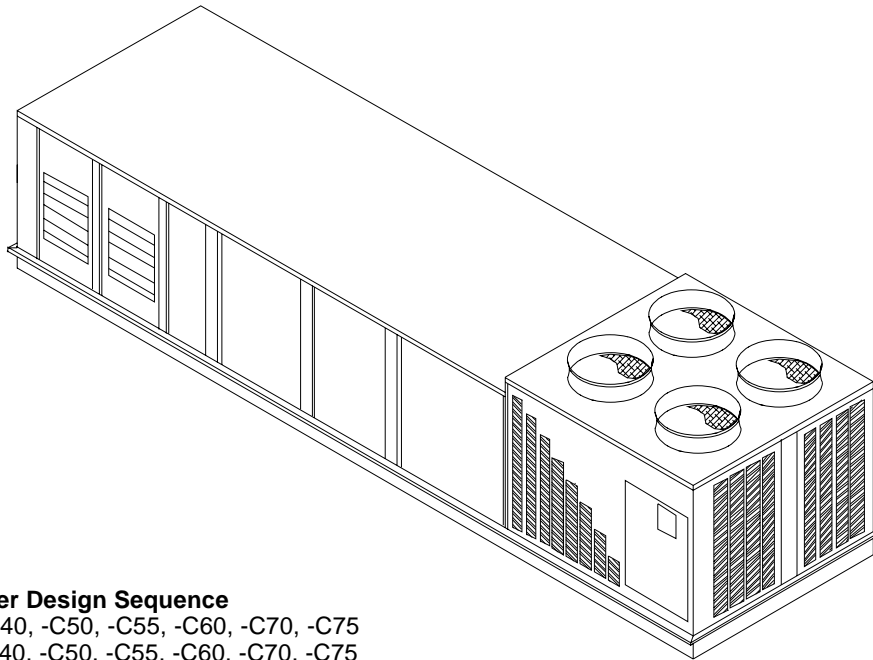
Installation Operation Maintenance

RT-SVX10C-EN

Library	Service Literature
Product Section	Unitary
Product	Rooftop Air Conditioning (Comm. SZ, 20 - 130 Tons)
Model	SAH_, SEH_, SFH_, SLH_, SSH_, SXH_
Literature Type	Installation/Operation/Maintenance
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INTELLIPAK™

Commercial Single-Zone Rooftop Air Conditioners with CV or VAV Controls



Models

"5" and later Design Sequence

- SAHF** -C20, -C25, -C30, -C40, -C50, -C55, -C60, -C70, -C75
- SEHF** -C20, -C25, -C30, -C40, -C50, -C55, -C60, -C70, -C75
- SFHF** -C20, -C25, -C30, -C40, -C50, -C55, -C60, -C70, -C75
- SLHF** -C20, -C25, -C30, -C40, -C50, -C55, -C60, -C70, -C75
- SSHF** -C20, -C25, -C30, -C40, -C50, -C55, -C60, -C70, -C75
- SXHF** -C20, -C25, -C30, -C40, -C50, -C55, -C60, -C70, -C75

"X" and later Design Sequence

- SXHG** -C90, -D11, -D12, -D13 **SEHG** -C90, -D11, -D12, -D13
- SFHG** -C90, -D11, -D12, -D13 **SLHG** -C90, -D11, -D12, -D13
- SSHG** -C90, -D11, -D12, -D13

With 3-D™ Scroll Compressors



- Units whose model numbers have a "1" in digit 20 are certified by Underwriters Laboratory.



- Units whose model numbers have a "2" in digit 20 are certified by the Canadian Standards Association (CSA).

Trane has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice. Only qualified technicians should perform the installation and servicing of equipment referred to in this publication.

Note: This document is customer property and must be retained by the unit's owner for use by maintenance personnel.

Literature Change History

RT-SVX10C-EN (November 2004)

Re-issue of manual for minor corrections to Connection Sizes Table 3-5; provides specific installation, operation and maintenance instructions for S_HF with "6" and later design sequence and S_HG with "Y" and later design sequence with constant volume (CV) or variable air volume (VAV) controls.

RT-SVX10C-EN (October 2004)

Re-issue of manual for minor corrections to warranty and updated sensor numbers (BAYSENS019, 20); provides specific installation, operation and maintenance instructions for S_HF with "6" and later design sequence and S_HG with "Y" and later design sequence with constant volume (CV) or variable air volume (VAV) controls.

RT-SVX10C-EN (July 2004)

Re-issue of manual for minor WARNING and CAUTIONS and Warranty information updates; provides specific installation, operation and maintenance instructions for S_HF with "6" and later design sequence and S_HG with "Y" and later design sequence with constant volume (CV) or variable air volume (VAV) controls.

RT-SVX10C-EN (December 2003)

Re-issue of manual for minor changes to programming parameters; provides specific installation, operation and maintenance instructions for S_HF with "6" and later design sequence and S_HG with "Y" and later design sequence with constant volume (CV) or variable air volume (VAV) controls.

About The Manual

RT-SVX10B-EN (October 2003)

Updated issue of this manual; provides specific installation, operation and maintenance instructions for S_HF with "6" and later design sequence and S_HG with "Y" and later design sequence with constant volume (CV) or variable air volume (VAV) controls.

RT-SVX10A-EN (May 2003)

Updated issue of this manual; provides specific installation, operation and maintenance instructions for S_HF with "5" and later design sequence and S_HG with "X" and later design sequence with constant volume (CV) or variable air volume (VAV) controls.

SXH_IOM-9 (November 2002)

Re-issue of manual for minor clarity issues; provides specific installation, operation and maintenance instructions for "3" and later design sequence on S_HF units and "W" and later design sequence on S_HG units with constant volume (CV) or variable air volume (VAV) controls.

SXH_IOM-9 (June 2002)

Original issue of manual; provides specific installation, operation and maintenance instructions for "3" and later design sequence on S_HF units and "W" and later design sequence on S_HG units with constant volume (CV) or variable air volume (VAV) controls.

These units are equipped with electronic Unit Control Modules (UCM) which provides operating functions that are significantly different than conventional units. Refer to the "Start-Up" and "Test Mode" procedures within this Installation, Operation, & Maintenance manual and the latest edition of the appropriate programming manual for CV or VAV applications before attempting to operate or service this equipment.

Note: The procedures discussed in this manual should only be performed by qualified, experienced HVAC technicians.

Overview of Manual

This booklet describes proper installation, start-up, operation, and maintenance procedures for 20 through 130 Ton rooftop air conditioners designed for Constant Volume (CV) and Variable Air Volume (VAV) applications. By carefully reviewing the information within this manual and following the instructions, the risk of improper operation and/or component damage will be minimized.

Note: One copy of the appropriate service literature ships inside the control panel of each unit.

It is important that periodic maintenance be performed to help assure trouble free operation. Should equipment failure occur, contact a qualified service organization with qualified, experienced HVAC technicians to properly diagnose and repair this equipment.

Note: Do Not release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all federal, state, and local laws.

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General Information

Model Number Description

All products are identified by a multiple character model number listed on the unit nameplate. An explanation of the alphanumeric identification code is provided below. Its use can define the unit's specific components, type of application, i.e. CV or VAV, for a particular unit.

Sample Model No.: S X H F - C20 4 0 A 1 0 A 1 5 B 1 D 0 1 A,R,L,etc.
Digit No.: 1 2 3 4 5,6,7 8 9 10 11 12 13 14 15 16 17 18 19 20 21+

Digit 1 - Unit Type
 S = Self-Contained

Digit 2 - Unit Function
 A = DX Cooling, No Heat
 E = DX Cooling, Electric Heat
 F = DX Cooling, Natural Gas Heat
 L = DX Cooling, Hot Water Heat
 S = DX Cooling, Steam Heat
 X = DX Cooling, Extended Casings
 # = DX Cooling, Propane Gas Heat

Digit 3 - Unit Airflow
 H = Single-Zone

Digit 4 - Development Sequence
 F = Sixth

Digits 5, 6, 7 - Nominal Capacity
 C20 = 20 Tons C55 = 55 Tons
 C25 = 25 Tons C60 = 60 Tons
 C30 = 30 Tons C70 = 70 Tons
 C40 = 40 Tons C75 = 75 Tons
 C50 = 50 Tons

Digit 8 - Power Supply
 4 = 460/60/3 XL
 5 = 575/60/3 XL
 E = 200/60/3 XL
 F = 230/60/3 XL

Note: SEHF units (unit with electric heat) utilizing 208V or 230V require dual power source.

Digit 9 - Heating Capacity

Note: When the second digit calls for "F" (Gas Heat), the following values apply: Additionally, please note G and M available ONLY on 50 Ton models and above.

H = High Heat - 2 Stage
 L = Low Heat - 2 Stage
 0 = No Heat
 J = Limited Modulating High Heat
 G = Limited Modulating Low Heat
 P = Full Modulating High Heat
 M = Full Modulating Low Heat

Note: When the second digit calls for "E" (electric heat), the following values apply:

D = 30 KW R = 130 KW
 H = 50 KW U = 150 KW
 L = 70 KW V = 170 KW
 N = 90 KW W = 190 KW
 Q = 110 KW

Note: When the second digit calls "L" (Hot Water) or "S" (Steam) Heat, one of the following valve size values must be in Digit 9:
 High Heat Coil: 1 = 50", 2 = .75", 3 = 1", 4 = 1.25", 5 = 1.5", 6 = 2".
 Low Heat Coil: A = .50", B = .75", C = 1", D = 1.25", E = 1.5", F = 2".

Digit 10 - Design Sequence
 3 = Disconnect Redesign
Note: Sequence may be any letter A thru Z, or any digit 1 thru 9.

Digit 11 - Exhaust Option
 0 = None
 1 = Barometric
 2 = 100% - 1.5 HP*
 3 = 100% - 3 HP*
 4 = 100% - 5 HP*
 5 = 100% - 7.5 HP*
 6 = 100% - 10 HP*
 7 = 100% - 15 HP*
 8 = 100% - 20 HP*
 A = 50% - 1.5 HP
 B = 50% - 3 HP
 C = 50% - 5 HP
 D = 50% - 7.5 HP
 E = 100% - 1.5 HP**
 F = 100% - 3 HP**
 G = 100% - 5 HP**
 H = 100% - 7.5 HP**
 J = 100% - 10 HP**
 K = 100% - 15 HP**
 L = 100% - 20 HP**
 # = 50% w/ Statitrac
 * w/Statitrac
 ** w/o Statitrac (CV only)

Digit 12 - Exhaust Fan Drive
 0 = None 8 = 800 PRM
 4 = 400 RPM 9 = 900 RPM
 5 = 500 RPM A = 1000 RPM
 6 = 600 RPM B = 1100 RPM
 7 = 700 RPM

Digit 13 - Filter Type
 A = Throwaway
 B = Cleanable Wire Mesh
 C = High-Efficiency Throwaway
 D = Bag with Prefilters
 E = Cartridge with Prefilters
 F = No Filters (T/A Rack Only)
 G = No Filters (Bag/Cart. Rack Only)

Digit 14 - Supply Fan Horsepower
 1 = 3.0 HP 6 = 20.0 HP
 2 = 5.0 HP 7 = 25.0 HP
 3 = 7.5 HP 8 = 30.0 HP
 4 = 10.0 HP 9 = 40.0 HP¹
 5 = 15.0 HP

Digit 15 - Supply Fan Drive
 5 = 500 RPM B = 1100 RPM
 6 = 600 RPM C = 1200 RPM
 7 = 700 RPM D = 1300 RPM
 8 = 800 RPM E = 1400 RPM
 9 = 900 RPM F = 1500 RPM
 A = 1000 RPM G = 1600 RPM

Digit 16 - Fresh Air Section
 A = No Fresh Air
 B = 0-25% Manual
 D = 0-100% Economizer

When ordering replacement parts or requesting service, be sure to refer to the specific model number, serial number, and DL number (if applicable) stamped on the unit nameplate.

Digit 17 - System Control
 1 = CV Control (Zone Control)
 2 = VAV-(S/A Temp Control without Inlet Guide Vanes)
 3 = VAV-(S/A Temp Control with Inlet Guide Vanes)
 4 = Space Pressure Control with Exhaust VFD without Bypass
 5 = Space Pressure Control with Exhaust VFD and Bypass
 6 = VAV Supply Air Temperature Control with VFD w/o Bypass
 7 = VAV Supply Air Temperature Control with VFD and Bypass
 8 = Supply and Exhaust Fan with VFD without Bypass
 9 = Supply and Exhaust Fan with VFD and Bypass

Digit 18 - Accessory Panel
 0 = None
 A = BAYSENS008*
 B = BAYSENS010*
 C = BAYSENS013*
 D = BAYSENS014*
 E = BAYSENS019*
 F = BAYSENS020*
 G = BAYSENS021*

Digit 19 - Ambient Control
 0 = Standard
 1 = 0 Degree Fahrenheit

Digit 20 - Agency Approval
 0 = None (UL Gas Heater, see note)
 1 = UL
 2 = CSA

Note: Includes UL classified gas heating section only when second digit of Model No. is a "F".

Digits 21 - 38 - Miscellaneous
 21 A = Unit Disconnect Switch
 22 B = Hot Gas Bypass
 23 C = Economizer Control w/Comparative Enthalpy
 23 Z = Economizer Control w/Reference Enthalpy
 23 W = Economizer Control w/Dry Bulb
 23 O = None W/O Economizer
 24 E = Low Leak Fresh Air Dampers
 25 F = High Duct Temperature Thermostat
 26 G = High Capacity Evaporator Coil
 27 H = Copper Fins (Cond. only)
 28 K = Generic B.A.S. Module
 29 L = High-Efficiency Motors (Supply & Exhaust)
 30 M = Remote Human Interface
 31 N = Ventilation Override Module
 32 R = Extended Grease Lines
 33 T = Access Doors
 34 V = Interprocessor Communications Bridge
 35 0 = No communication module
 35 Y = Trane Communication Interface Module
 35 7 = LonTalk® Communication Interface Module
 36 8 = Spring Isolators
 37 6 = Factory-Powered 15A GFI Convenience Outlet
 38 0 = None

1. Available as standard 460 volt only for 70 and 75 ton models.

Sample Model No.: S X H G - D 1 1 4 0 A H 7 C G 8 D 1 0 0 1 AT,etc

Digit No.: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21+

Digit 1 - Unit Type

S = Self-Contained

Digit 2 - Unit Function(s)

E = DX Cooling, Electric Heat
F = DX Cooling, Natural Gas Heat
L = DX Cooling, Hot Water Heat
S = DX Cooling, Steam Heat
X = DX Cooling, Extended Casings

Digit 3 - Unit Airflow

H = Single-Zone

Digit 4 - Development Sequence

G = Seventh

Digits 5, 6, 7 - Nominal Capacity

C90 = 90 Tons
D11 = 105 Tons
D12 = 115 Tons
D13 = 130 Tons

Digit 8 Power Supply

4 = 460/60/3 XL
5 = 575/60/3 XL
E = 200/60/3 XL
F = 230/60/3 XL

Digit 9 - Heating Capacity

0 = No Heat
H = High Heat - 2 Stage
J = Limited Modulating High Heat
P = Full Modulating High Heat

Note: When the second digit calls for "E" (electric heat), the following values apply in the ninth digit:
W=190 kw

Note: When the second digit calls for "L" or "S", one of the following valve size values must be in Digit 9:

High Heat Coil: 3 = 1.0", 4 = 1.25",
5 = 1.50", 6 = 2.0", 7 = 2.5"
Low Heat Coil: C = 1.0", D = 1.25",
E = 1.50", F = 2.0", G = 2.5"

Digit 10 - Design Sequence

W = Disconnect Redesign

Note: Sequence may be any letter A thru Z, or any digit 1 thru 9.

Digit 11 - Exhaust Option

O = None
7 = 100%, 15 HP w/ Statitrac
8 = 100%, 20 HP w/ Statitrac
9 = 100%, 25 HP w/ Statitrac
F = 50%, 15 HP
H = 100%, 30 HP w/ Statitrac
J = 100%, 40 HP w/ Statitrac
K = 100%, 15 HP w/o Statitrac (CV Only)
L = 100%, 20 HP w/o Statitrac (CV Only)
M = 100%, 25 HP w/o Statitrac (CV Only)
N = 100%, 30 HP w/o Statitrac (CV Only)
P = 100%, 40 HP w/o Statitrac (CV Only)

Digit 12 - Exhaust Air Fan Drive

0 = None
5 = 500 RPM
6 = 600 RPM
7 = 700 RPM
8 = 800 RPM

Digit 13 - Filter

A = Throwaway
C = High-Efficiency Throwaway
D = Bag with Prefilter
E = Cartridge with Prefilter
F = Throwaway Filter Rack Less Filter Media
G = Bag Filter Rack Less Filter Media

Digit 14 - Supply Air Fan HP

C = 30 HP (2-15 HP)
D = 40 HP (2-20 HP)
E = 50 HP (2-25 HP)
F = 60 HP (2-30 HP)
G = 80 HP (2-40 HP)

Digit 15 - Supply Air Fan Drive

A = 1000 RPM
B = 1100 RPM
C = 1200 RPM
D = 1300 RPM
E = 1400 RPM
F = 1500 RPM
G = 1600 RPM

Digit 16 - Fresh Air

D = 0-100% Economizer (Std.)

Digit 17 - System Control

1 = Constand Volume Control
2 = VAV Supply Air Temperature Control without Inlet Guide Vanes
3 = VAV - Supply Air Temperature Control with Inlet Guide Vanes
4 = Space Pressure Control with Exhaust VFD w/o Bypass
5 = Space Pressure Control with Exhaust and Bypass
6 = VAV Supply Air Temperature Control with VFD without Bypass
7 = VAV Supply Air Temperature Control with VFD and Bypass
8 = Supply and Exhaust Fan with VFD and without Bypass
9 = Supply and Exhaust Fan with VFD and Bypass

Digit 18 - Accessory Panel

0 = None
A = BAYSENS008*
B = BAYSENS010*
C = BAYSENS013*
D = BAYSENS014*
E = BAYSENS019*
F = BAYSENS020*
G = BAYSENS021*

Digit 19 - Ambient Control

0 = Standard

Digit 20 - Agency Approval

0 = None (UL Gas Heater See Note 1)
1 = UL
2 = CSA

Note: Includes UL classified gas heating section only when second digit of Model No. is a "F".

Digits 21 - 36 - Miscellaneous

21 A = Unit Disconnect Switch
22 B = Hot Gas Bypass
23 C = Economizer Control with Comparative Enthalpy
23 Z = Economizer Control with Reference Enthalpy
23 W = Economizer Control w/Dry Bulb
23 0 = None W/O Economizer
24 E = Low-Leak Fresh Air Dampers
25 F = High Duct Temperature Thermostat
26 G = High Capacity Evaporator Coil (90 - 105 Only)
27 K = Generic BAS Module
28 L = High Efficiency Motors (Supply and Exhaust)
29 M = Remote Human Interface
30 N = Ventilation Override Module
31 R = Extended Grease Lines
32 T = Access Doors
33 V = Inter-processor Communication Bridge
34 0 = No communication module
34 Y = Trane Communication Interface Module
34 7 = LonTalk® Communication Interface Module
35 0 = None
36 6 = Factory-Powered 15A GFI Convenience Outlet

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Unit Nameplate

One Mylar unit nameplate is located on the outside upper left corner of the control panel door. It includes the unit model number, serial number, electrical characteristics, weight, refrigerant charge, as well as other pertinent unit data. A small metal nameplate with the Model Number, Serial Number, and Unit Weight is located just above the Mylar nameplate, and a third nameplate is located on the inside of the control panel door.

Compressor Nameplate

The Nameplate for the Scroll Compressor is located on the compressor lower housing.

Hazard Identification



WARNING— Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION – Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



WARNING Fiberglass Wool

Product contains fiberglass wool. Disturbing the insulation in this product during installation, maintenance or repair will expose you to airborne particles of glass wool fibers and ceramic fibers known to the state of California to cause cancer through inhalation. Glass wool fibers may also cause respiratory, skin or eye irritation.

Precautionary Measures

- Avoid breathing fiberglass dust.
- Use a NIOSH approved dust/mist respirator.
- Avoid contact with the skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves, and eye protection.
- Wash clothes separately from other clothing: rinse washer thoroughly.
- Operations such as sawing, blowing, tear-out, and spraying may generate fiber concentrations requiring additional respiratory protection. Use the appropriate NIOSH approved respiration in these situations.

First Aid Measures

Eye Contact - Flush eyes with water to remove dust. If symptoms persist, seek medical attention.

Skin Contact - Wash affected areas gently with soap and warm water after handling.

Commonly Used Acronyms

For convenience, a number of acronyms and abbreviations are used throughout this manual. These acronyms are alphabetically listed and defined below.

BAS = Building automation systems
CFM = Cubic-feet-per-minute
CKT. = Circuit
CV = Constant volume
CW = Clockwise
CCW = Counterclockwise
E/A = Exhaust air
ECEM = Exhaust/comparative enthalpy module
F/A = Fresh air
GBAS = Generic building automation system
HGBP = Hot gas bypass
HI = Human Interface
HVAC = Heating, ventilation and air conditioning
IGV = Inlet guide vanes
I/O = Inputs/outputs
IOM = Installation/operation/ maintenance manual
IPC = Interprocessor communications
IPCB = Interprocessor communications bridge
LCI-I = LonTalk Communication Interface for IntelliPak
LH = Left-hand
MCM = Multiple compressor module
MWU = Morning warm-up
NSB = Night setback
O/A = Outside air
psig = Pounds-per-square-inch, gauge pressure
R/A = Return air
RH = Right-hand
RPM = Revolutions-per-minute
RT = Rooftop unit
RTM = Rooftop module
S/A = Supply air
SCM = Single circuit module
SZ = Single-zone (unit airflow)
TCI = Tracer communications module
UCM = Unit control modules
VAV = Variable air volume
VCM = Ventilation control module
VOM = Ventilation override module
w.c. = Water column

Unit Description

Each Trane commercial, single-zone rooftop air conditioner ships fully assembled and charged with the proper refrigerant quantity from the factory.

An optional roof curb, specifically designed for the S_HF and S_HG units is available from Trane. The roof curb kit must be field assembled and installed according to the latest edition of SAHF-IN-5 or SXHG-IN-2 respectively.

Trane Commercial Rooftop Units are controlled by a micro-electronic control system that consists of a network of modules and are referred to as Unit Control Modules (UCM). The acronym UCM is used extensively throughout this document when referring to the control system network.

These modules through Proportional/Integral control algorithms perform specific unit functions which provide the best possible comfort level for the customer.

They are mounted in the control panel and are factory wired to their respective internal components. They receive and interpret information from other unit modules, sensors, remote panels, and customer binary contacts to satisfy the applicable request for economizing, mechanical cooling, heating, and ventilation. Refer to the following discussion for an explanation of each module function.

Rooftop Module (RTM - 1U48 Standard on all units)

The Rooftop Module (RTM) responds to cooling, heating, and ventilation requests by energizing the proper unit components based on information received from other unit modules, sensors, remote panels, and customer supplied binary inputs. It initiates supply fan, exhaust fan, exhaust damper, inlet guide vane positioning or variable frequency drive output, and economizer operation based on that information.

RTM Resistance Input vs Setpoint Temperatures

RTM cooling or heating setpoint input used as the source for a ZONE temp setpoint (°F)	RTM cooling setpoint input used as the source for SUPPLY AIR temp setpoint cooling (°F)	Resistance (Ohms) Max. Tolerance 5%
40	40	1084
45	45	992
50	50	899
55	55	796
60	60	695
65	65	597
70	70	500
75	75	403
80	80	305
n/a	85	208
n/a	90	111

RTM Resistance Value vs System Operating Mode

Resistance applied to RTM MODE input Terminals (Ohms) Max. Tolerance 5%	Constant Volume Units	
	Fan Mode	System Mode
2320	Auto	Off
4870	Auto	Cool
7680	Auto	Auto
10770	On	Off
13320	On	Cool
16130	On	Auto
19480	Auto	Heat
27930	On	Heat

Compressor Module (SCM & MCM - 1U49 standard on all units)

The Compressor module, (Single Circuit & Multiple Circuit), upon receiving a request for mechanical cooling, energizes the appropriate compressors and condenser fans. It monitors the compressor operation through feedback information it receives from various protection devices.

Human Interface Module (HI - 1U65 standard on all units)

The Human Interface module enables the operator to adjust the operating parameters for the unit using it's 16 key keypad. The 2 line, 40 character LCD screen provides status information for the various unit functions as well as menus for the operator to set or modify the operating parameters.

Heat Module (1U50 used on heating units)

The Heat module, upon receiving a request for Heating, energizes the appropriate heating stages or strokes the Modulating Heating valve as required.

General Information (Continued)

Ventilation Override Module (VOM - Optional 1U51)

The Ventilation Override module initiates specified functions such as; space pressurization, exhaust, purge, purge with duct pressure control, and unit off when any one of the five (5) binary inputs to the module are activated. The compressors and condenser fans are disabled during the ventilation operation. If more than one ventilation sequence is activated, the one with the highest priority is initiated.

Interprocessor Communications Board (IPCB - Optional 1U55 used with the Optional Remote Human Interface)

The Interprocessor Communication Board expands communications from the rooftop unit UCM network to a Remote Human Interface Panel. DIP switch settings on the IPCB module for this application should be; Switches 1 and 2 "Off", Switch 3 "On".

Trane Communications Interface Module (TCI - Optional 1U54 used on units with Trane ICS™)

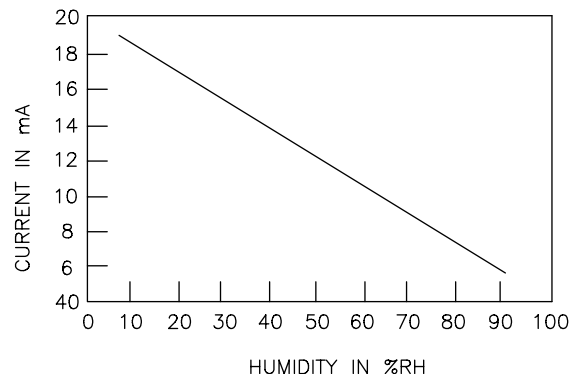
The Trane Communication Interface module expands communications from the unit UCM network to a Trane Tracer 100™ or a Tracer Summit™ system and allows external setpoint adjustment and monitoring of status and diagnostics. DIP Switch settings on the TCI module for these applications should be:
Tracer 100 (Comm3): Switches 1, 2, and 3 are "Off";
Tracer Summit (Comm4): Switch 1 is "On", switches 2, and 3 are "Off"

Lontalk Communication Interface Module (LCI - Optional 1U54 - used on units with Trane ICS™ or 3rd party Building Automation Systems)

The LonTalk Communication Interface module expands communications from the unit UCM network to a Trane Tracer Summit™ or a 3rd party building automation system, utilizing LonTalk, and allows external setpoint and configuration adjustment and monitoring of status and diagnostics.

Exhaust/Comparative Enthalpy Module (ECEM - Optional 1U52 used on units with Statitrac and/or comparative enthalpy options)

The Exhaust/Comparative Enthalpy module receives information from the return air humidity sensor, the outside air humidity sensor, and the return air temperature sensor to utilize the lowest possible humidity level when considering economizer operation. In addition, it receives space pressure information which is used to maintain the space pressure to within the setpoint controlband. Refer to the table below for the Humidity vs Voltage input values.



Ventilation Control Module (VCM - Design special option only)

The Ventilation Control Module (VCM) is located in the filter section of the unit and is linked to the unit's UCM network. Using a "velocity pressure" sensing ring located in the fresh air section, allows the VCM to monitor and control the quantity of fresh air entering the unit to a minimum airflow setpoint.

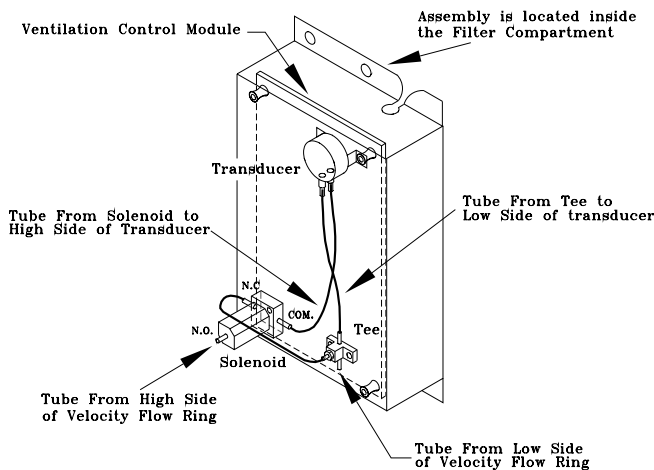
An optional temperature sensor can be connected to the VCM which enables it to control a field installed fresh air preheater.

An optional CO₂ sensor can be connected to the VCM to control CO₂ reset. The reset function adjust the minimum CFM upward as the CO₂ concentrations increase. The maximum effective (reset) setpoint value for fresh air entering the unit is limited to the systems operating CFM. The following table lists the Minimum Outside Air CFM vs Input Voltage.

Minimum Outside Air Setpoint w/VCM Module & Traq™ Sensing		
Unit	Input Volts	CFM
20 & 25 Ton	0.5 - 4.5 vdc	0 - 14000
30 Ton	0.5 - 4.5 vdc	0 - 17000
40 Ton	0.5 - 4.5 vdc	0 - 22000
50 & 55 Ton	0.5 - 4.5 vdc	0 - 28000
60 thru 75 Ton	0.5 - 4.5 vdc	0 - 33000
90 thru 130 Ton	0.5 - 4.5 vdc	0 - 46000

The velocity pressure transducer/solenoid assembly is illustrated below. Refer to the "Traq™ Sensor Sequence of Operation" section for VCM operation.

Velocity Pressure Transducer/Solenoid Assembly



Generic Building Automation System Module (GBAS - Optional 1U51 used with non-Trane building control systems)

The Generic Building Automation System (GBAS) module allows a non-Trane building control system to communicate with the rooftop unit and accepts external setpoints in form of analog inputs for cooling, heating, supply air pressure, and a binary Input for demand limit. Refer to the "Field Installed Control Wiring" section for the input wiring to the GBAS module and the various desired setpoints with the corresponding DC voltage inputs for both VAV and CV applications.

General Information (Continued)

For complete application details of the module, refer to Engineering Bulletin RT-EB-109.

Input Devices & System Functions

The descriptions of the following basic Input Devices used within the UCM network are to acquaint the operator with their function as they interface with the various modules. Refer to the unit's electrical schematic for the specific module connections.

Constant Volume & Variable Air Volume Units

Supply Air Temperature Sensor (3RT9)

Is an analog input device used with CV & VAV applications. It monitors the supply air temperature for; supply air temperature control (VAV), supply air temperature reset (VAV), supply air temperature low limiting (CV), supply air tempering (CV/VAV). It is mounted in the supply air discharge section of the unit and is connected to the RTM (1U48).

Return Air Temperature Sensor (3RT6)

Is an analog input device used with a return humidity sensor on CV & VAV applications when the comparative enthalpy option is ordered. It monitors the return air temperature and compares it to the outdoor temperature to establish which temperature is best suited to maintain the cooling requirements. It is mounted in the return air section and is connected to the ECEM (1U52).

Evaporator Temperature Sensor (3RT14 and 3RT15)

Is an analog input device used with CV & VAV applications. It monitors the refrigerant temperature inside the evaporator coil to prevent coil freezing. It is attached to the suction line near the evaporator coil and is connected to the SCM/MCM (1U49). It is factory set for 30 F and has an adjustable range of 25 F to 35 F. The compressors are staged "Off" as necessary to prevent icing. After the last compressor stage has been turned "Off", the compressors will be allowed to restart once the evaporator temperature rises 10 F above the "coil frost cutout temperature" and the minimum three minute "Off" time has elapsed.

Filter Switch (3S21)

Is a binary input device used on CV & VAV applications. It measures the pressure differential across the unit filters. It is mounted in the filter section and is connected to the RTM (1U48). A diagnostic SERVICE signal is sent to the remote panel if the pressure differential across the filters is at least 0.5" w.c.. The contacts will automatically open when the pressure differential across the filters decrease to 0.4" w.c.. The switch differential can be field adjusted between 0.17" w.c. to 5.0" w.c. ± 0.05" w.c..

Supply and Exhaust Airflow Proving Switches (3S68 and 3S69)

3S68 is a binary input device used on CV & VAV applications to signal the RTM when the supply fan is operating. It is located in the supply fan section of the unit and is connected to the RTM (1U48). During a request for fan operation, if the differential switch is detected to be open for 40 consecutive seconds; compressor operation is turned "Off", heat operation is turned "Off", the request for supply fan operation is turned "Off" and locked out, IGV's (if equipped) are "closed", exhaust dampers (if equipped) are "closed", economizer dampers (if equipped) are "closed", and a manual reset diagnostic is initiated.

General Information (Continued)

3S69 is a binary input device used on all rooftop units equipped with an exhaust fan. It is located in the exhaust fan section of the unit and is connected to the RTM (1U48). During a request for fan operation, if the differential switch is detected to be open for 40 consecutive seconds, the economizer is closed to the minimum position setpoint, the request for exhaust fan operation is turned "Off" and locked out, and a manual reset diagnostic is initiated. The fan failure lockout can be reset; at the Human Interface located in the unit's control panel, by Tracer, or by cycling the control power to the RTM (1S70 Off/On).

Lead-Lag

Is a selectable mode of operation on 40 thru 130 Ton units within the Human Interface. It alternates the starting between the first compressor of each refrigeration circuit. Only the compressor banks will switch, not the order of the compressors within a bank, providing the first compressor in each circuit had been activated during the same request for cooling.

Supply and Exhaust Fan Circuit Breakers (1CB1, 1CB2)

The supply fan and exhaust fan motors are protected by circuit breakers 1CB1 and 1CB2 respectively. They will trip and interrupt the power supply to the motors if the current exceeds the breaker's "must trip" value. The rooftop module (RTM) will shut all system functions "Off" when an open fan proving switch is detected.

Low Pressure Control

Is accomplished using a binary input device on CV & VAV applications. LP cutouts are located on the suction lines near the scroll compressors.

The LPC contacts are designed to close when the suction pressure exceeds 22 ± 4 psig. If the LP control is open when a compressor is requested to start, none of the compressors on that circuit will be allowed to operate. They are locked out and a manual reset diagnostic is initiated.

The LP cutouts are designed to open if the suction pressure approaches 7 ± 4 psig. If the LP cutout opens after a compressor has started, all compressors operating on that circuit will be turned off immediately and will remain off for a minimum of three minutes.

If the LP cutout trips four consecutive times during the first three minutes of operation, the compressors on that circuit will be locked out and a manual reset diagnostic is initiated.

Saturated Condenser Temperature Sensors (2RT1 and 2RT2)

Are analog input devices used on CV & VAV applications mounted inside a temperature well located on a condenser tube bend. They monitor the saturated refrigerant temperature inside the condenser coil and are connected to the SCM/MCM (1U49). As the saturated refrigerant temperature varies due to operating conditions, the condenser fans are cycled "On" or "Off" as required to maintain acceptable operating pressures.

Head Pressure Control

is accomplished using two saturated refrigerant temperature sensors on CV & VAV applications. During a request for compressor operation, when the condensing temperature rises above the "lower limit" of the controlband, the Compressor Module (SCM/MCM) starts sequencing con-

denser fans "On". If the operating fans can not bring the condensing temperature to within the controlband, more fans are turned on. As the saturated condensing temperature approaches the lower limit of the controlband, fans are sequenced "Off". The minimum "On/Off" time for condenser fan staging is 5.2 seconds. If the system is operating at a given fan stage below 100% for 30 minutes and the saturated condensing temperature is above the "efficiency check point" setting, a fan stage will be added. If the saturated condensing temperature falls below the "efficiency check point" setting, the fan control will remain at the present operating stage. If a fan stage cycles four times within a 10 minute period, the control switches from controlling to the "lower limit" to a temperature equal to the "lower limit" minus the "temporary low limit suppression" setting. It will utilize this new "low limit" temperature for one hour to reduce condenser fan short cycling.

High Pressure Controls

High Pressure controls are located on the discharge lines near the scroll compressors. They are designed to open when the discharge pressure approaches 405 ± 7 psig. The controls reset automatically when the discharge pressure decreases to approximately 300 ± 20 psig. However, the compressors on that circuit are locked out and a manual reset diagnostic is initiated.

Outdoor Air Humidity Sensor (3U63)

Is an analog input device used on CV & VAV applications with 100% economizer. It monitors the outdoor humidity levels for economizer operation. It is mounted in the fresh air intake section and is connected to the RTM (1U48).

Return Air Humidity Sensor (3U64)

Is an analog input device used on CV & VAV applications with the comparative enthalpy option. It monitors the return air humidity level and compares it to the outdoor humidity level to establish which conditions are best suited to maintain the cooling requirements. It is mounted in the return air section and is connected to the ECEM (1U52).

Low Ambient Control

The low ambient modulating output on the compressor module is functional on all units with or without the low ambient option. When the compressor module has staged up to its highest stage (stage 2 or 3 depending on unit size), the modulating output will be at 100% (10 VDC). When the control is at stage 1, the modulating output (0 to 10 VDC) will control the saturated condensing temperature to within the programmable "condensing temperature low ambient control point".

Status/Annunciator Output

Is an internal function within the RTM (1U48) module on CV & VAV applications that provides;

- a. diagnostic and mode status signals to the remote panel (LEDs) and to the Human Interface.
- b. control of the binary Alarm output on the RTM.
- c. control of the binary outputs on the GBAS module to inform the customer of the operational status and/or diagnostic conditions.

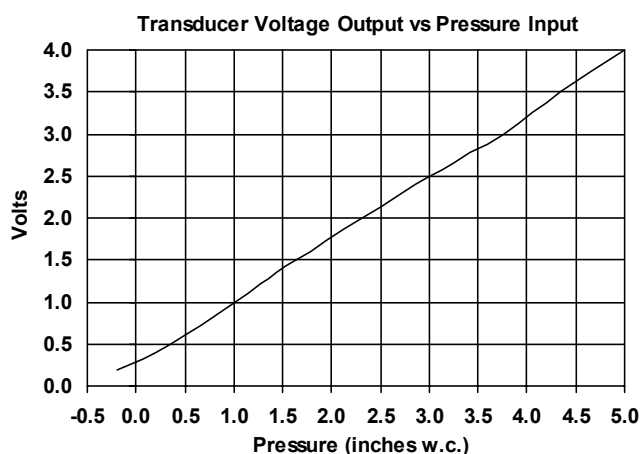
General Information (Continued)

Low Ambient Compressor Lockout

Utilizes an analog input device for CV & VAV applications. When the system is configured for low ambient compressor lockout, the compressors are not allowed to operate if the temperature of the outside air falls below the lockout setpoint. When the temperature rises 5 F above the lockout setpoint, the compressors are allowed to operate. The setpoint for units without the low ambient option is 50 F. For units with the low ambient option, the setpoint is 0 F. The setpoints are adjustable at the Human Interface inside the unit control panel.

Space Pressure Transducer (3U62)

Is an analog input device used on CV & VAV applications with the Statitrac option. It modulates the exhaust dampers to keep the space pressure within the building to a customer designated controlband. It is mounted in the filter section just above the exhaust damper actuator and is connected to the ECEM (1U52). Field supplied pneumatic tubing must be connected between the space being controlled and the transducer assembly.



Morning Warm-Up - Zone Heat

When a system changes from an unoccupied to an occupied mode, or switches from STOPPED to AUTO, or power is applied to a unit with the MWU option, the heater in the unit or external heat will be brought on if the space temperature is below the MWU setpoint. The heat will remain on until the temperature reaches the MWU setpoint. If the unit is VAV, then the VAV box/unocc relay will continue to stay in the unoccupied position and the VFD/IGV output will stay at 100% during the MWU mode. When the MWU setpoint is reached and the heat mode is terminated, then the VAV box/unocc relay will switch to the occupied mode and the VFD/IGV output will be controlled by the duct static pressure. During Full Capacity MWU the economizer damper is held closed for as long as it takes to reach setpoint. During Cycling Capacity MWU the economizer damper is allowed to go to minimum position after one hour of operation if setpoint has not been reached.

Compressor Motor Winding Thermostats (2B7S1, 2B17S2, 2B27S5, 2B8S3, 2B18S4 & 2B28S6)

A thermostat is embedded in the motor windings of each Scroll compressor. Each thermostat is designed to open if the motor windings exceeds approximately 221 F. The thermostat will reset automatically when the winding temperature decreases to approximately 181 F. Rapid cycling, loss of charge, abnormally high suction temperatures, or the compressor running backwards could cause the thermostat to open. During a request for compressor operation, if the Compressor Module (SCM) detects a problem outside of its normal parameters, it turns any operating

compressor(s) on that circuit "Off", locks out all compressor operation for that circuit, and initiates a manual reset diagnostic.

Supply Air Temperature Low Limit

Uses the supply air temperature sensor input to modulate the economizer damper to minimum position in the event the supply air temperature falls below the occupied heating setpoint temperature.

Freezestat (4S12)

Is a binary input device used on CV & VAV units with Hydronic Heat. It is mounted in the heat section and connected to the Heat Module (1U50). If the temperature of the air entering the heating coil falls to 40 F, the normally open contacts on the freezestat closes signalling the Heat Module (1U50) and the Rooftop Module (RTM) to:

- drive the Hydronic Heat Actuator (4U15) to the full open position.
- turn the supply fan "Off".
- closes the outside air damper;
- turns "On" the SERVICE light at the Remote Panel.
- initiates a "Freezestat" diagnostic to the Human Interface.

High Duct Temp Thermostats (Optional 3S16, 3S17)

Are binary input devices used on CV & VAV applications with a Trane Communication Interface Module (TCI). They provide "high limit" shutdown of the unit and requires a manual reset. They are factory set to open if the supply air temperature reaches 240 F, or the return air temperature reaches 135 F. Once tripped, the thermostat can be reset by pressing the button located on the sensor once the air temperature has decreased approximately 25 F below the cutout point.

Compressor Circuit Breakers (1CB8, 1CB9, 1CB10, 1CB11 & 1CB14, 1CB15, 1CB16, 1CB17)

The Scroll Compressors are protected by circuit breakers which interrupt the power supply to the compressors if the current exceeds the breakers "must trip" value. During a request for compressor operation, if the Compressor Module (SCM) detects a problem outside of its normal parameters, it turns any operating compressor(s) on that circuit "Off", locks out all compressor operation for that circuit, and initiates a manual reset diagnostic.

Constant Volume (CV) Units

Zone Temperature - Cooling

Relies on input from a sensor located directly in the space, while a system is in the occupied "Cooling" mode. It modulates the economizer (if equipped) and/or stages the mechanical cooling "On and Off" as required to maintain the zone temperature to within the cooling setpoint deadband.

Zone Temperature - Heating

Relies on input from a sensor located directly in the space, while a system is in the occupied "Heating" mode or an unoccupied period, to stage the heat "on and off" or to modulate the heating valve (hydronic heat only) as required to maintain the zone temperature to within the heating setpoint deadband. The supply fan will be requested to operate any time there is a requested for heat. On gas heat units, the fan will continue to run for 60 seconds after the furnace is turned off.

Supply Air Tempering

On CV units equipped with staged heat, if the supply air temperature falls 10 F below the occupied heating setpoint temperature while the heater is "Off", the first stage of heat will be turned "On". The heater is turned "Off" when the supply air temperature reaches 10 F above the occupied heating setpoint temperature.

Variable Air Volume (VAV) Units

Occupied Heating - Supply Air Temperature

When a VAV unit is equipped with "Modulating Heat", and the system is in an occupied mode, and the field supplied changeover relay contacts (5K87) have closed, the supply air temperature will be controlled to the customer specified supply air heating setpoint. It will remain in the heating status until the changeover relay contacts are opened.

Occupied Cooling - Supply Air Temperature

When a VAV unit is in the occupied mode, the supply air temperature will be controlled to the customers specified supply air cooling setpoint by modulating the economizer and/or staging the mechanical cooling "On and Off" as required. The changeover relay contacts must be open on units with "Modulating Heat" for the cooling to operate.

Daytime Warm-up

On VAV units equipped with heat, if the zone temperature falls below the daytime warm-up initiate temperature during the occupied mode, the system will switch to full airflow. During this mode, the VAV box/unocc relay, RTM K3, will be energized (this is to signal the VAV boxes to go to 100%). After the VAV box max stroke time has elapsed (factory set at 6 minutes), the VFD/IGV output will be set to 100%. The airflow will be at 100% and the heat will be turned on to control to the occupied heating setpoint. When the zone temperature reaches the daytime warm-up termination setpoint, the heat will be turned off, the K3 relay will be de-energized, releasing the VAV boxes, the VFD/IGV output will go back to duct static pressure control

and the unit will return to discharge air control. If the occ zone heating setpoint is less than the DWU terminate setpoint, the heat will turn off when the occ zone heat setpoint is reached, but it will stay in DWU mode and cycle the heat to maintain setpoint.

Unoccupied Heating - Zone Temperature

When a VAV unit is equipped with gas, electric, or hydronic heat and is in the unoccupied mode, the zone temperature will be controlled to within the customers specified setpoint deadband. During an unoccupied mode for a VAV unit, the VAV box/unocc relay will be in the unoccupied position and the VFD/IGV output will be at 100%. This means that if there is a call for heat (or cool) and the supply fan comes on, it will be at full airflow and the VAV boxes in the space will need to be 100% open as signaled by the VAV box/unocc relay.

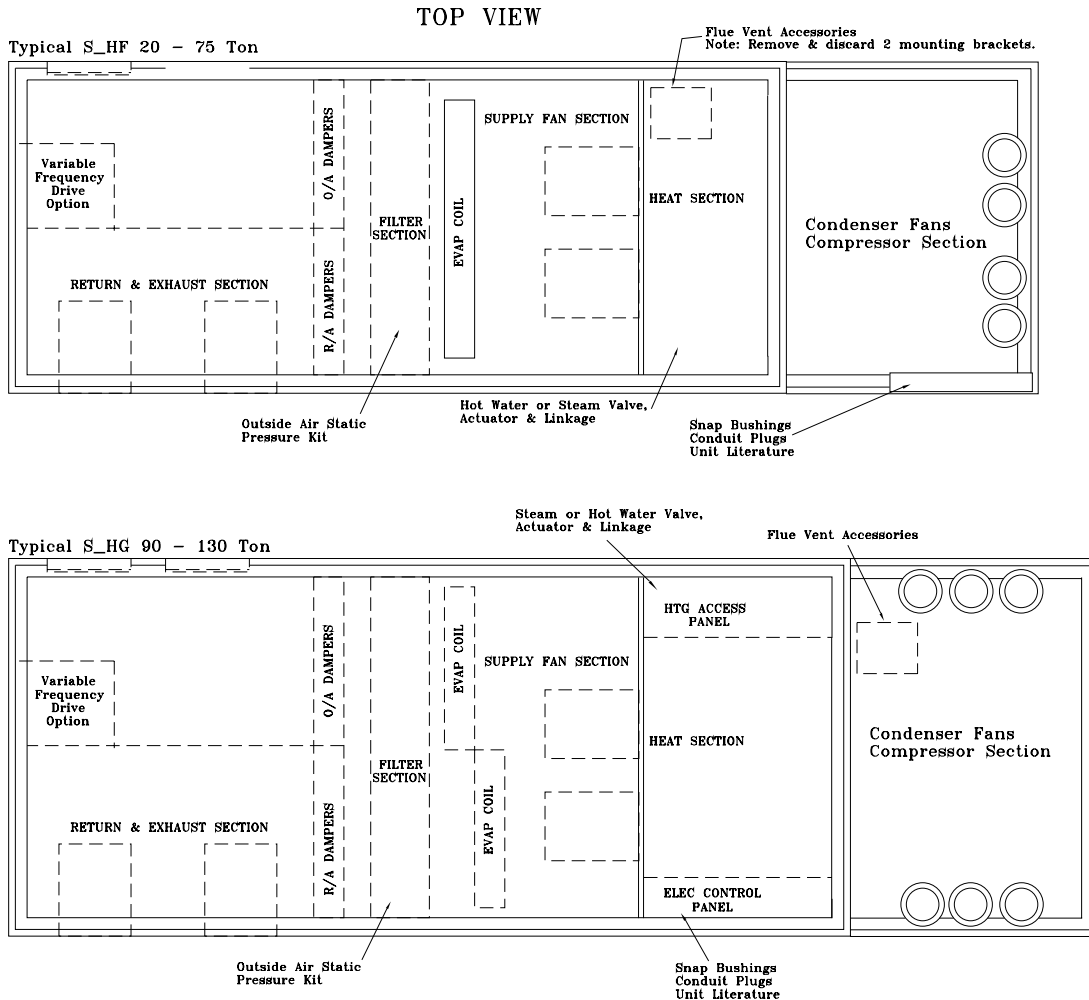
Supply Air Tempering

On VAV units equipped with "Modulating Heat", if the supply air temperature falls 10 F below the supply air temperature setpoint, the hydronic heat valve will modulate to maintain the supply air temperature to within the low end of the setpoint deadband.

Supply Duct Static Pressure Control (Occupied)

The RTM relies on input from the duct pressure transducer when a unit is equipped with Inlet Guide Vanes or a Variable Frequency Drive to position the Inlet Guide Vanes or set the supply fan speed to maintain the supply duct static pressure to within the static pressure setpoint deadband. Refer to the Transducer Voltage Output vs Pressure Input values listed in the Space Pressure Transducer (3U62) section.

Unit Component Layout and "Shipwith" Locations



Space Temperature Averaging

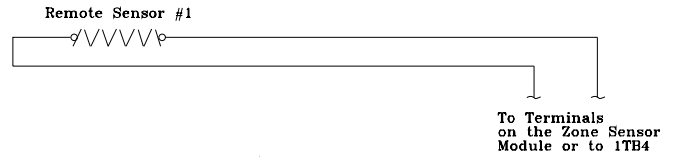
Space temperature averaging for Constant Volume applications is accomplished by wiring a number of remote sensors in a series/parallel circuit.

The fewest number of sensors required to accomplish space temperature averaging is four. Figure 8 illustrates a single sensor circuit (Single Zone), four sensors wired in a series/parallel circuit (Four Zone), nine sensors wired in a series/parallel circuit (Nine Zone). Any number squared, is the number of remote sensors required.

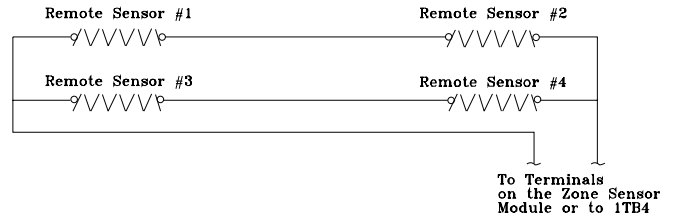
Wiring termination will depend on the type of remote panel or control configuration for the system. Refer to the wiring diagrams that shipped with the unit.

Space Temperature Averaging with Multiple Sensors

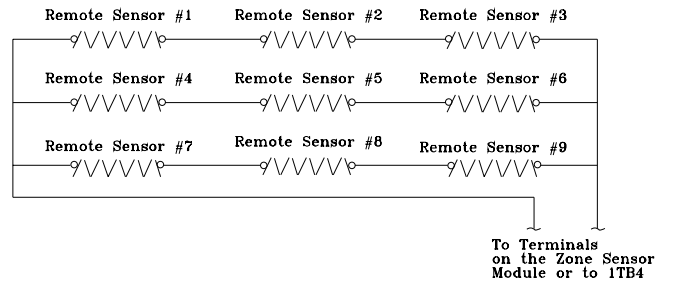
Single Zone Averaging Circuit



Four Zone Averaging Circuit



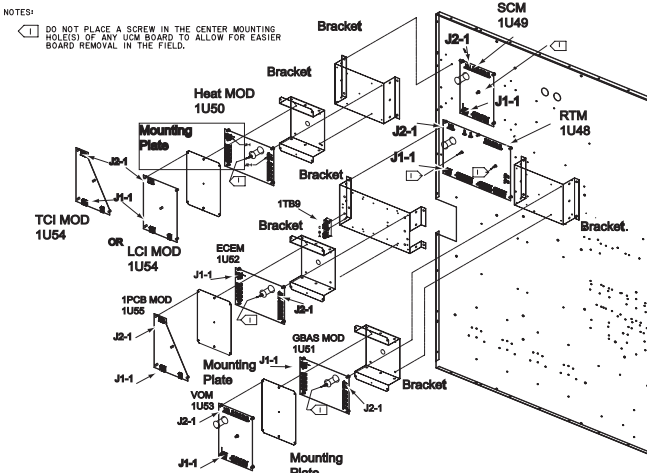
Nine Zone Averaging Circuit



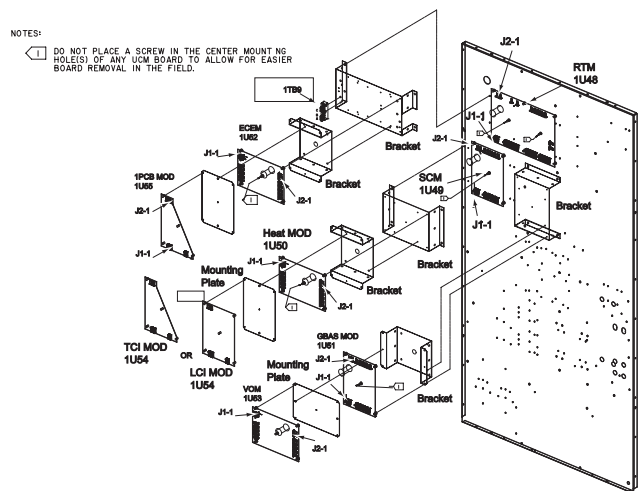
Unit Control Modules (UCM)

Unit control modules are microelectronic circuit boards designed to perform specific unit functions. These modules through Proportional/Integral control algorithms provide the best possible comfort level for the customer. They are mounted in the control panel and are factory wired to their respective internal components. They receive and interpret information from other unit modules, sensors, remote panels, and customer binary contacts to satisfy the applicable request for economizing, mechanical cooling, heating, and ventilation. Figure 9 below illustrates the typical location of each "1U" designated module.

Control Module Locations for S_HF 20 & 25 Ton Units



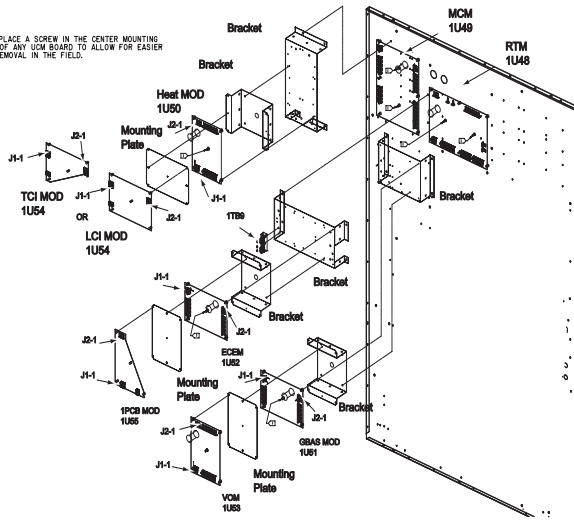
Control Module Locations for S_HF 30 Ton Units



Control Module Locations for S_HF 40, 60, 70 & 75 Ton Units

NOTES:

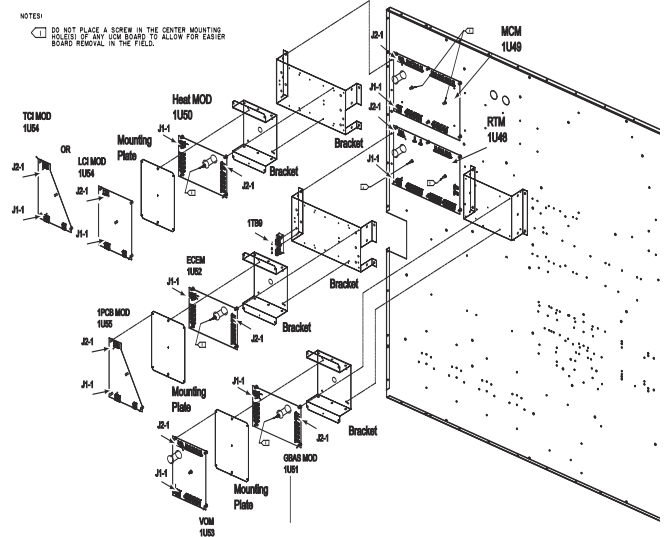
DO NOT PLACE A SCREW IN THE CENTER MOUNTING HOLES OF ANY UCM BOARD TO ALLOW FOR EASIER BOARD REMOVAL IN THE FIELD.



Control Module Locations for S_HF 50 & 55 Ton Units

NOTES:

DO NOT PLACE A SCREW IN THE CENTER MOUNTING HOLES OF ANY UCM BOARD TO ALLOW FOR EASIER BOARD REMOVAL IN THE FIELD.



Control Module Locations for S_HG 90 - 130 Ton Units

NOTES:

DO NOT PLACE A SCREW IN THE CENTER MOUNTING HOLES OF ANY UCM BOARD TO ALLOW FOR EASIER BOARD REMOVAL IN THE FIELD.

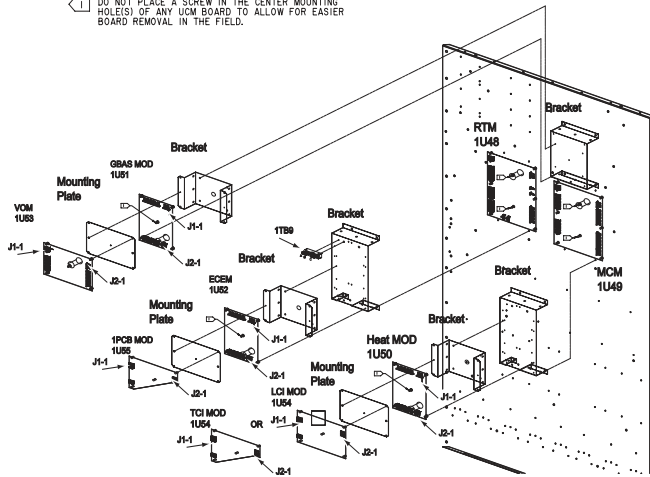


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Unit Inspection

As soon as the unit arrives at the job site

- [] Verify that the nameplate data matches the data on the sales order and bill of lading (including electrical data).
- [] Verify that the power supply complies with the unit nameplate specifications.
- [] Verify that the power supply complies with the electric heater specifications on the unit nameplate.
- [] Visually inspect the exterior of the unit, including the roof, for signs of shipping damage.
- [] Check for material shortages. Refer to the Component Layout and Shipwith Location illustration.

If the job site inspection of the unit reveals damage or material shortages, file a claim with the carrier immediately. Specify the type and extent of the damage on the "bill of lading" before signing.

- [] Visually inspect the internal components for shipping damage as soon as possible after delivery and before it is stored. Do not walk on the sheet metal base pans.



WARNING **No Step Surface!**

FOR ACCESS TO COMPONENTS, THE BASE SHEET METAL SURFACE MUST BE REINFORCED.

Bridging between the unit's main supports may consist of multiple 2 by 12 boards or sheet metal grating.

Failure to comply could result in death or severe personal injury from falling.

- [] If concealed damage is discovered, notify the carrier's terminal of damage immediately by phone and by mail. Concealed damage must be reported within 15 days.

Request an immediate joint inspection of the damage by the carrier and the consignee. Do not remove damaged material from the receiving location. Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.

- [] Remove the protective plastic coverings that shipped over the compressors.

Installation

Storage

Take precautions to prevent condensate from forming inside the unit's electrical compartments and motors if:

- a. the unit is stored before it is installed; or,
- b. the unit is set on the roof curb, and temporary heat is provided in the building. Isolate all side panel service entrances and base pan openings (e.g., conduit holes, S/A and R/A openings, and flue openings) from the ambient air until the unit is ready for startup.

Note: Do not use the unit's heater for temporary heat without first completing the startup procedure detailed under "Starting the Unit".

Trane will not assume any responsibility for equipment damage resulting from condensate accumulation on the unit's electrical and/or mechanical components.

Unit Clearances

Figure 3-1 illustrates the minimum operating and service clearances for either a single or multiple unit installation. These clearances are the minimum distances necessary to assure adequate serviceability, cataloged unit capacity, and peak operating efficiency.

Providing less than the recommended clearances may result in condenser coil starvation, "short-circuiting" of exhaust and economizer airflows, or recirculation of hot condenser air.

Unit Dimensions & Weight Information

Overall unit dimensional data for a SAHF (20 thru 75 Ton) cooling only unit is illustrated in Figure 3-2A. Tables 3-1A, 3-1B, and 3-1C list the dimensions. Dimensional data for SEH_, SFH_, SLH_, SSH_, and SXH_ (20 thru 130 Ton) units are illustrated in Figure 3-2B. Tables 3-2A, 3-2B, and 3-2C list the dimensions for the 20 thru 75 Ton units. Dimensions for 90 through 130 Ton units are listed on the illustration in Figure 3-2C.

A Center-of-Gravity illustration and the dimensional data is shown in Figure 3-3.

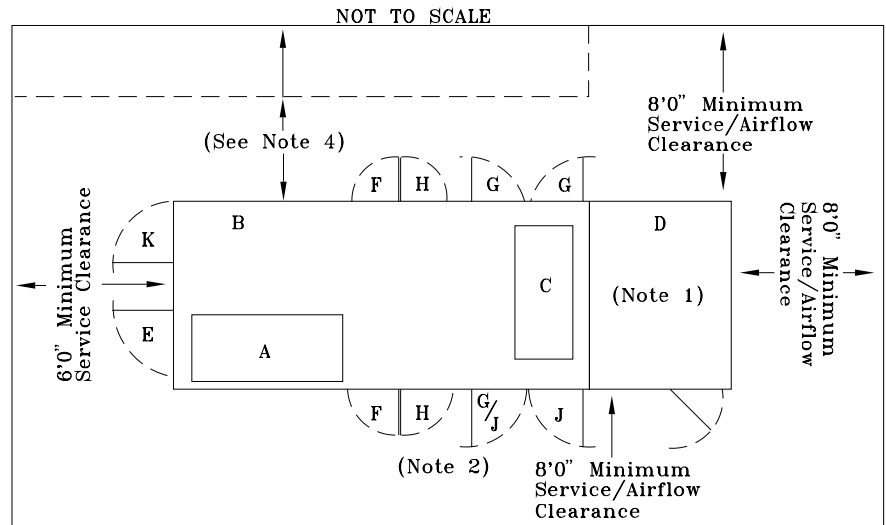
Table 3-3 list the typical unit and curb operating weights. Weights shown represent approximate operating weights. Actual weights are stamped on the unit nameplate.

Figure 3-1
Minimum Operation and Service Clearances for Single & Multiple Unit Installation

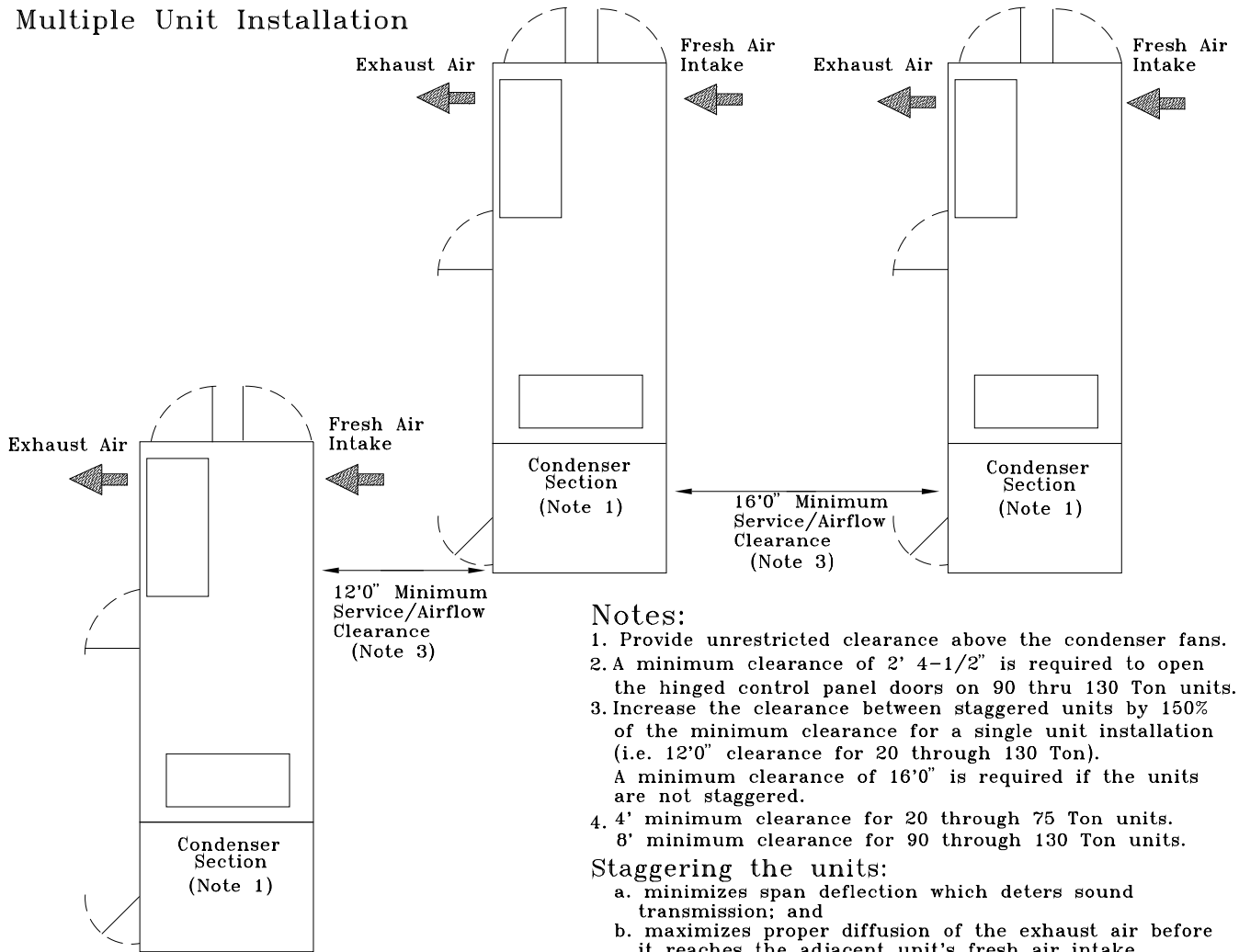
Single Unit Installation

Legend

- A = Return Air Opening
- B = Fresh Air Intake
- C = Supply Air Opening
- D = Condenser Section
- E = Optional 2'10-3/4" Access Door (180° swing)
- F = Hinged 2'10-3/4" Filter Access Door (180° swing)
- G = Hinged 2'10-3/4" Heater Access Door (180° swing)
- H = Hinged 2'10-3/4" Supply Fan Access Door (180° swing) (90 thru 130 Ton)
- J = Hinged 2'4-1/2" Control Panel Door (180° Swing) (90 thru 130 Ton)
- K = VFD Access Panel



Multiple Unit Installation



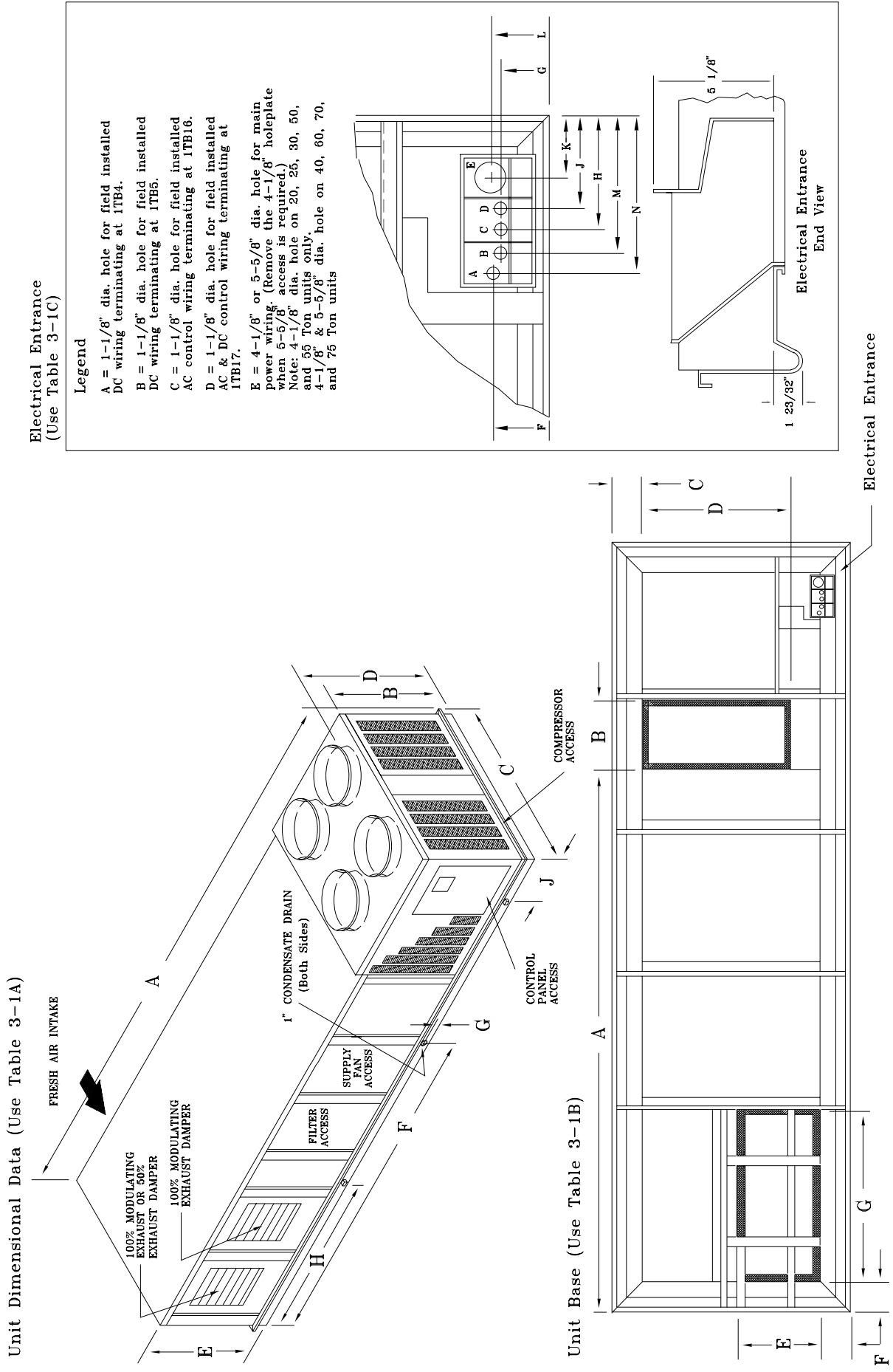
Notes:

1. Provide unrestricted clearance above the condenser fans.
2. A minimum clearance of 2' 4-1/2" is required to open the hinged control panel doors on 90 thru 130 Ton units.
3. Increase the clearance between staggered units by 150% of the minimum clearance for a single unit installation (i.e. 12'0" clearance for 20 through 130 Ton).
 A minimum clearance of 16'0" is required if the units are not staggered.
4. 4' minimum clearance for 20 through 75 Ton units.
 8' minimum clearance for 90 through 130 Ton units.

Staggering the units:

- a. minimizes span deflection which deters sound transmission; and
- b. maximizes proper diffusion of the exhaust air before it reaches the adjacent unit's fresh air intake.

Figure 3-2A
SAHF Cooling-Only Units (20 thru 75 Ton)



Installation (Continued)

Table 3-1A
Unit Dimensional Data

Unit Size	Dimensions								
	A	B	C	D	E	F	G	H	J
20 & 25 Ton	21'-9 3/4"	5'-3 1/8"	7'-6 1/2"	5'-8 15/16"	3'-9 5/16"	12'-6"	1"	7'	1'-3 1/2"
30 Ton	21'-9 3/4"	5'-8 5/8"	7'-6 1/2"	6'-2 7/16"	4'-9 5/16"	12'-6"	1"	7'	1'-3 1/2"
40 Ton	27'-0"	6'-1 5/8"	7'-6 1/2"	6'-7 3/8"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"
50 & 55 Ton	29'-8"	5'-3 1/8"	7'-6 1/2"	5'-8 7/8"	6'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"
60 Ton	27'-0"	6'-1 5/8"	9'-8"	6'-7 3/8"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"
70 & 75 Ton	27'-0"	6'-1 5/8"	9'-8"	6'-7 3/8"	5'-9 5/16"	15'-11 1/8"	1"	8'	1'-4"

Table 3-1B
Unit Base Dimensional Data

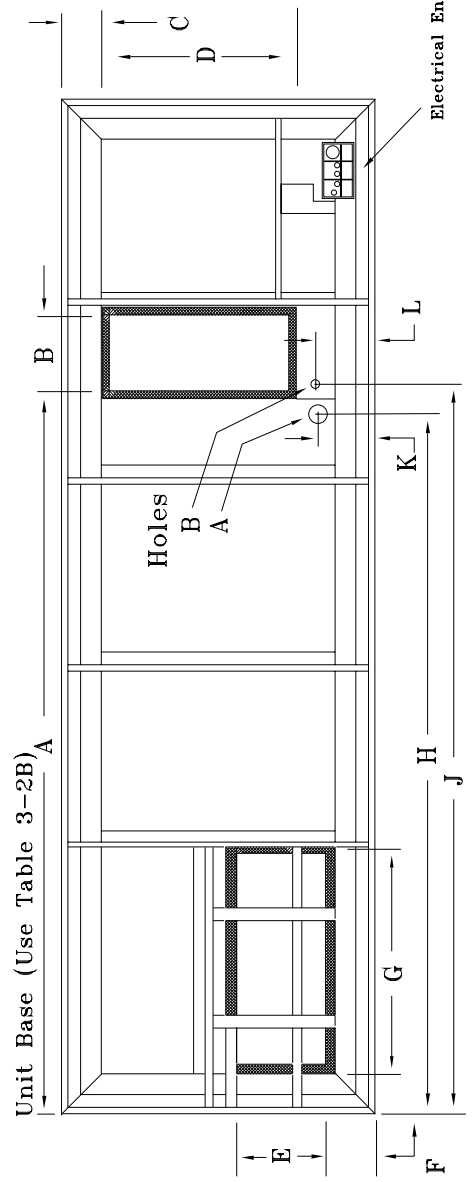
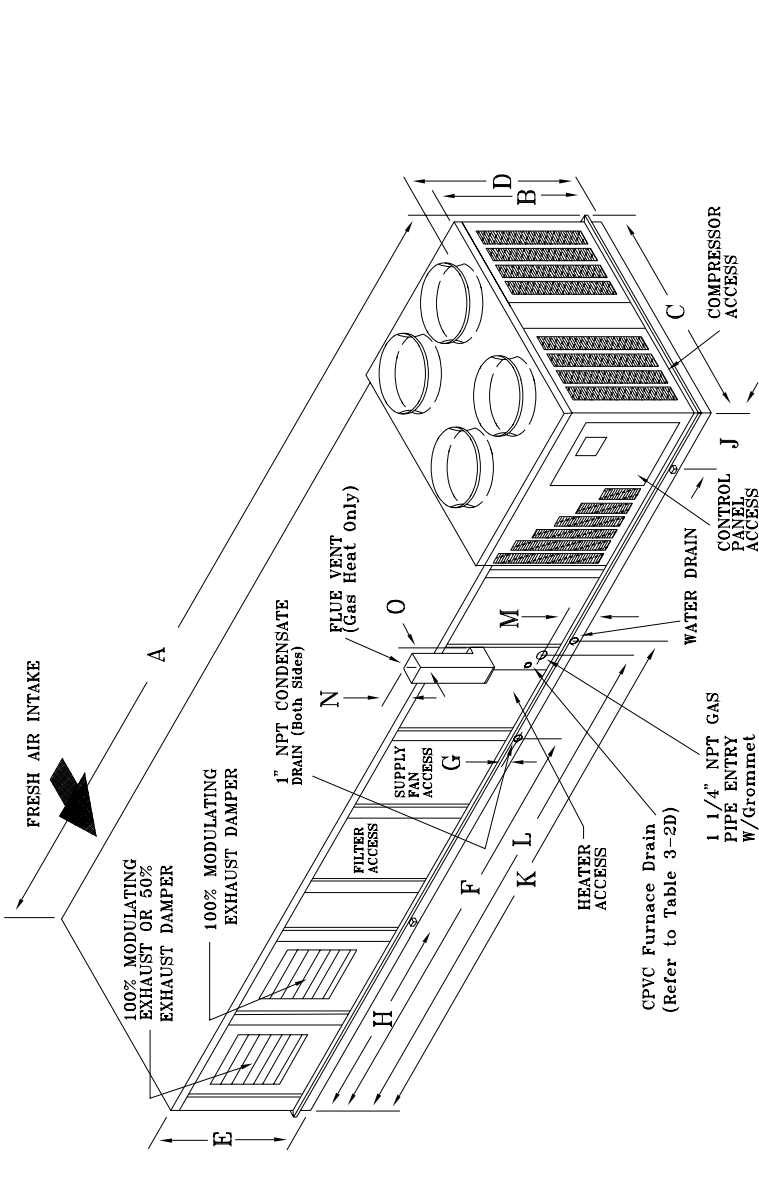
Unit Size	Dimensions						
	A	B	C	D	E	F	G
20 - 30 Ton	14'-0 1/4"	2'-2 1/2"	11 3/4"	5'-7"	3'-4 3/8"	5 13/16"	6'-6 15/16"
40 - 55 Ton	16'-7 13/16"	2'-5"	11 3/4"	5'-7"	3'-4 3/8"	5 13/16"	7'-8 3/16"
60 Ton	16'-7 13/16"	2'-5"	1'-4 9/16"	6'-10 7/8"	4'-5 3/8"	5 13/16"	7'-8 3/16"
70 - 75 Ton	16'-7 13/16"	2'-5"	1'-4 9/16"	6'-10 7/8"	4'-5 3/8"	5 13/16"	7'-8 3/16"

Table 3-1C
Electrical Entrance Data

Unit Size	Dimensions							
	F	G	H	J	K	L	M	N
20, 25, & 30 50 & 55 Ton	8 7/32"	6 31/32"	15 21/32"	13 21/32"	9 17/32"	8 1/2"	18 1/16"	19 9/16"
40, 60, 70 & 75 Ton	8 3/4"	7 3/4"	17 7/8"	15 7/8"	9 29/32"	10 1/16"	20 13/32"	22 5/32"

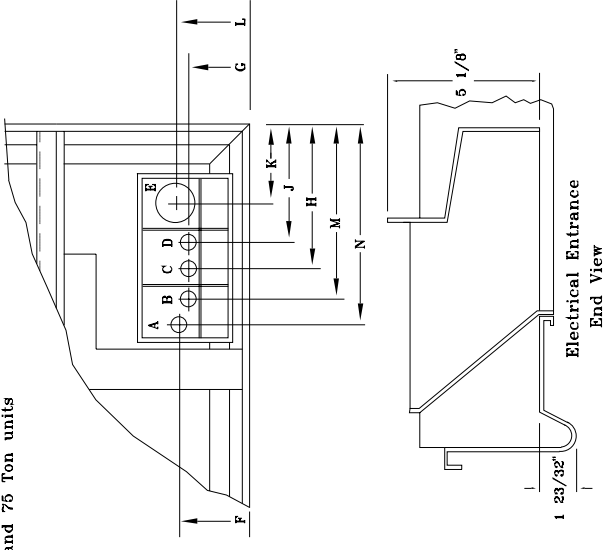
Figure 3-2B
SEHF, SFHF, SLHF, SSHF, SXHF Units (20 thru 75 Ton)

Unit Dimensional Data (Use Table 3-2A)



Electrical Entrance
(Use Table 3-2C)

- Legend**
- A = 1-1/8" dia. hole for field installed DC wiring terminating at ITB4.
 - B = 1-1/8" dia. hole for field installed DC wiring terminating at ITB5.
 - C = 1-1/8" dia. hole for field installed AC control wiring terminating at ITB16.
 - D = 1-1/8" dia. hole for field installed AC & DC control wiring terminating at ITB17.
 - E = 4-1/8" or 5-5/8" dia. hole for main power wiring. (Remove the 4-1/8" holeplate when 5-5/8" access is required.)
 - Note: 4-1/8" dia. hole on 20, 25, 30, 50, and 55 Ton units only.
 - 4-1/8" & 5-5/8" dia. hole on 40, 60, 70, and 75 Ton units



Unit Base Notes:

- SEHF - For 208/230 volt electric heat units, use hole "A" (3-5/8" Dia.).
- SFHF & SSHF - For Gas Heat units, use hole "B" (1-1/4" Dia.).
- SLHF & SLHF - For steam or hot water heat units, use holes "A" (3-5/8" Steam or Hot Water Supply) & "B" (3" Steam or Hot Water Return).
- SXHF - Extended cabinet cooling only units, the holes are omitted.

Installation (Continued)

Table 3-2A
Unit Dimensional Data

Unit Size	Dimensions								
	A	B	C	D	E	F	G	H	J
20 & 25 Ton	24'-1 3/8"	5'-3 1/8"	7'-6 1/2"	5'-8 15/16"	3'-9 5/16"	13'-3"	1"	7'	1'-3 1/2"
30 Ton	24'-1 3/8"	5'-8 5/8"	7'-6 1/2"	6'-2 3/8"	4'-9 5/16"	13'-3"	1"	7'	1'-3 1/2"
40 Ton	30'-2 1/2"	6'-1 5/8"	7'-6 1/2"	6'-7 3/8"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"
50 & 55 Ton	32'-10 1/2"	5'-3 1/8"	7'-6 1/2"	5'-8 7/8"	6'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"
60 Ton	30'-2 1/2"	6'-1 5/8"	9'-8"	6'-7 3/8"	5'-9 5/16"	15'-11 1/8"	1"	8'	2'-5"
70 & 75 Ton	30'-2 1/2"	6'-1 5/8"	9'-8"	6'-7 3/8"	5'-9 5/16"	15'-11 1/8"	1"	8'	1'-4"

Dimensions

K	L	M	N	O
16'-7"	16'-6"	8 1/8"	6 1/4"	9"
16'-7"	16'-6"	8 1/8"	6 1/4"	9"
19'-7"	See Note	8 1/8"	6 1/4"	9"
19'-7"	See Note	8 1/8"	6 1/4"	9"
19'-7"	See Note	8 1/8"	6 1/4"	9"

Note: 19'-6" for SFHF "Low Heat" units or 20'-3" for SFHF "High Heat" units.

Table 3-2B
Unit Base Dimensional Data

Unit Size	Dimensions							
	A	B	C	D	E	F	G	H
20 - 30 Ton	16'-3 3/16"	2'-2 1/2"	5 13/16"	5'-7"	3'-4 3/8"	5 13/16"	6'-6 15/16"	15'-5 5/16"
40 - 55 Ton	19'-10 5/16"	2'-5"	7 1/16"	5'-7"	3'-4 3/8"	5 13/16"	7'-8 3/16"	18'-11 11/16"
60 Ton	19'-10 5/16"	2'-5"	6 1/16"	Note 1	4'-5 3/8"	5 13/16"	7'-8 3/16"	18'-11 11/16"
70 - 75 Ton	19'-10 5/16"	2'-5"	6 1/16"	Note 1	4'-5 3/8"	5 13/16"	7'-8 3/16"	18'-11 11/16"

Unit Size	Dimensions		
	J	K	L
20 - 30 Ton	16'-9 3/4"	8 13/16"	9 1/16"
40 - 55 Ton	20'-1 3/4"	8 3/16"	9 1/16"
60 Ton	20'-1 3/4"	8 3/16"	9 1/16"
70 - 75 Ton	20'-1 3/4"	8 3/16"	9 1/16"

Note:

1. 5'-5 15/16" for SEHF units or 7'-8 1/2" for SFHF, SLHF, SSHF, SXHF units.

Table 3-2C
Electrical Entrance Data

Unit Size	Dimensions							
	F	G	H	J	K	L	M	N
20, 25, & 30 50 & 55 Ton	8 7/32"	6 31/32"	15 21/32"	13 21/32"	9 17/32"	8 1/2"	18 1/16"	19 9/16"
40, 60, 70 & 75 Ton	8 3/4"	7 3/4"	17 7/8"	15 7/8"	9 29/32"	10 1/16"	20 13/32"	22 5/32"

Table 3-2D
CPVC Dimensional Data

Unit Size	Furnace Size/MBH	Dimensions (Note)	
		Length	Height
20 & 25 Ton	Low = 235	195-5/32"	9-5/32"
	High = 500	195-5/32"	9-5/32"
30 Ton	Low = 350	195-5/32"	9-5/32"
	High = 500	195-5/32"	9-5/32"
40 Ton	Low = 350	240-1/8"	9-5/32"
	High = 850	231-1/8"	9-5/32"

Unit Size	Furnace Size/MBH	Dimensions (Note)	
		Length	Height
50 - 75 Ton	Low = 500	240-1/8"	9-5/32"
	High = 850	231-1/8"	9-5/32"
90 -130 Ton	1000	267-3/16"	10-11/32"

Note: The length dimension is from the exhaust end of the unit. The height dimension is from the bottom of the unit base rail.

Figure 3-2C
S_HG Cooling & Heating Units (90 through 130 Ton)

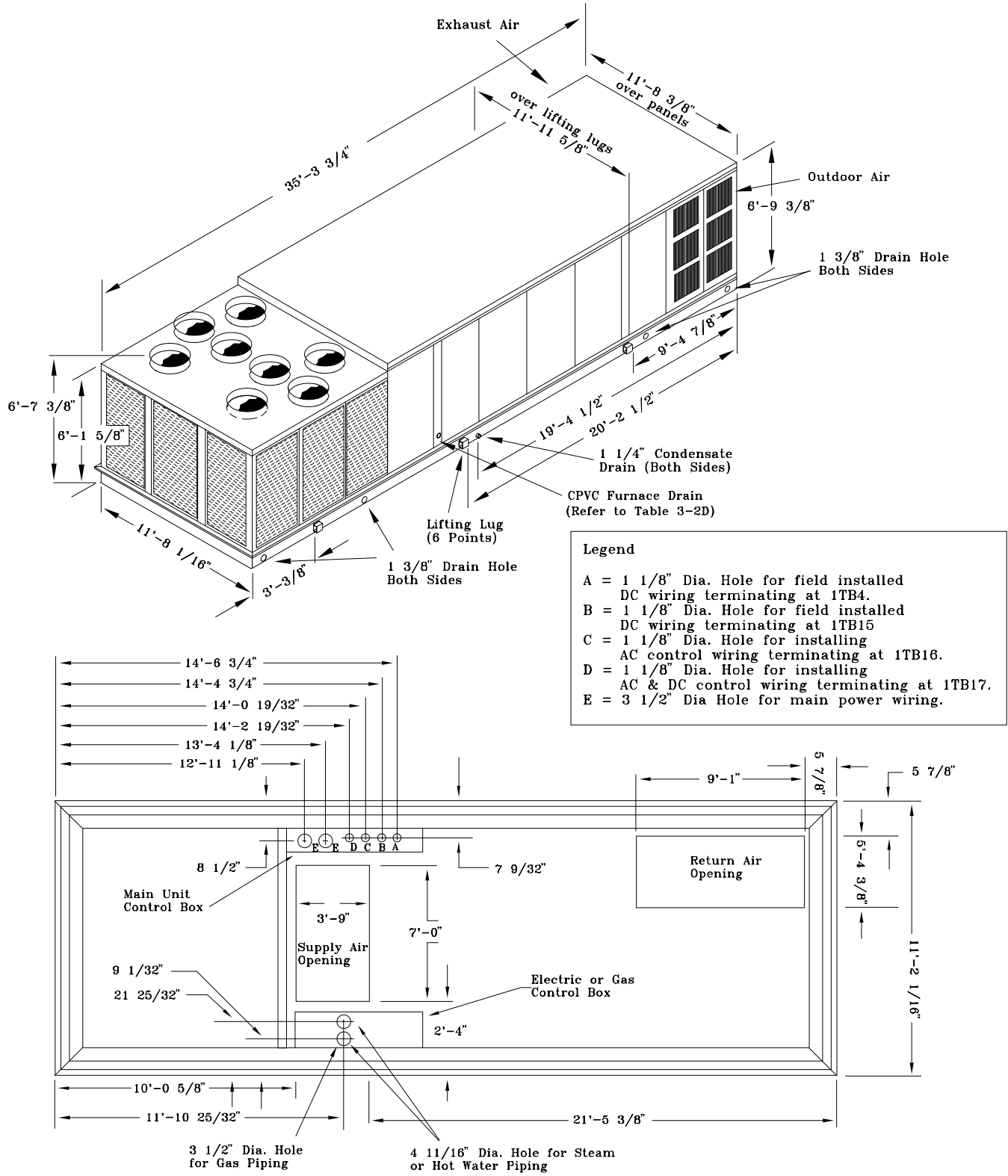
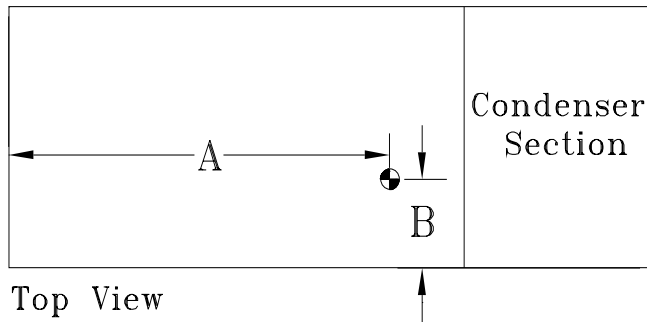


Figure 3-3
Center-of-Gravity Data (See Note 1)



Unit Model	Unit Size	Units with 100% Exhaust Fan		Units without Exhaust Fan		Units with Supply & Exhaust VFD	
		Dim. A	Dim. B	Dim. A	Dim. B	Dim. A	Dim. B
SAHF	C20	12' 6"	3' 8"	13' 5"	3' 10"	11' 10"	3' 9"
	C25	12' 9"	3' 8"	13' 7"	3' 10"	12' 0"	3' 9"
	C30	12' 5"	3' 8"	13' 3"	3' 10"	11' 9"	3' 9"
	C40	15' 7"	3' 10"	16' 9"	4' 0"	14' 10"	3' 11"
	C50	16' 7"	3' 10"	17' 9"	4' 0"	15' 8"	3' 11"
	C55	16' 10"	3' 10"	18' 1"	4' 0"	16' 0"	3' 11"
	C60	15' 7"	4' 7"	16' 11"	4' 10"	14' 10"	4' 8"
	C70	15' 10"	4' 8"	17' 1"	4' 10"	15' 2"	4' 9"
	C75	15' 11"	4' 8"	17' 2"	4' 10"	15' 2"	4' 9"
SEHF	C20	13' 8"	3' 8"	14' 7"	3' 10"	12' 11"	3' 9"
SLHF	C25	13' 10"	3' 7"	14' 9"	3' 9"	13' 1"	3' 9"
SSHF	C30	13' 6"	3' 8"	14' 5"	3' 9"	12' 10"	3' 9"
SXHF	C40	17' 10"	3' 10"	18' 3"	3' 11"	16' 3"	3' 11"
	C50	18' 1"	3' 10"	19' 4"	4' 0"	17' 2"	3' 11"
	C55	18' 5"	3' 11"	19' 8"	4' 0"	17' 8"	3' 10"
	C60	17' 0"	4' 7"	18' 6"	4' 9"	16' 3"	4' 8"
	C70	17' 5"	4' 8"	18' 9"	4' 10"	16' 7"	4' 9"
	C75	17' 5"	4' 8"	18' 9"	4' 10"	16' 7"	4' 9"
	SFHF	C20	13' 10"	3' 8"	14' 8"	3' 10"	13' 1"
C25		14' 0"	3' 7"	14' 10"	3' 9"	13' 3"	3' 8"
C30		13' 8"	3' 8"	14' 6"	3' 9"	13' 0"	3' 9"
C40		17' 3"	3' 9"	18' 5"	3' 11"	16' 6"	3' 10"
C50		18' 2"	3' 10"	19' 4"	4' 0"	17' 4"	3' 11"
C55		18' 6"	3' 10"	19' 8"	3' 11"	17' 8"	3' 10"
C60		17' 3"	4' 6"	18' 7"	4' 9"	16' 5"	4' 7"
C70		17' 6"	4' 7"	18' 9"	4' 10"	16' 9"	4' 8"
C75		17' 6"	4' 7"	18' 9"	4' 10"	16' 9"	4' 8"
SXHG, SEHG, SLHG, SSHG	C90	18' 9"	5' 10"	20' 4"	6' 2"	17' 9"	5' 10"
	D11	19' 1"	5' 11"	20' 7"	6' 2"	18' 1"	6' 0"
SFHG	C90	18' 11"	6' 0"	20' 6"	6' 3"	17' 10"	5' 11"
	D11	19' 3"	6' 0"	20' 9"	6' 4"	18' 4"	6' 7"
SXHG, SEHG, SLHG, SSHG	D12	19' 2"	5' 10"	20' 8"	6' 2"	18' 1"	6' 0"
	D13	19' 5"	5' 10"	20' 11"	6' 2"	18' 6"	6' 0"
SFHG	D12	19' 4"	6' 0"	20' 9"	6' 3"	18' 3"	6' 1"
	D13	19' 6"	6' 0"	21' 10"	6' 3"	18' 8"	6' 0"

Note:

1. Dimensions shown for the center-of-gravity are approximate and are based on a unit equipped with: Standard coils, 100% economizer, throwaway filters, hi-efficiency motors, inlet guide vanes, 460 volt XL start, high capacity heat (as applicable).

Table 3-3
Typical Unit & Curb Weights

Unit Size	Typical Unit Operating Weight (1)							Roof Curb Max. Weight (3)	
	SAHF	SE,SL, SSHF	SFHF	SXHF	SEHG	SFHG	SXHG	SAHF	S*HF/G
C20	4360	4690	4970	4580				490	510
C25	4520	4860	5130	4750				490	510
C30	5220	5590	5840	5460				490	510
C40	6890	7400	7880	7240				515	550
C50	7890	8450	8900	8290				515	550
C55	8140	8690	9170	8540				515	550
C60	9320	9650	10120	9480				610	640
C70	9860	10160	10640	10040				610	640
C75	9860	10160	10640	10040				610	640
C90					14730	15400	14580		770
D11					15310	15940	15160		770
D12					15730	16370	15560		770
D13					16080	16710	15930		770

Unit Size	Typical Unit Operating Weight (2)							Roof Curb Max. Weight (3)	
	SAHF	SE,SL, SSHF	SFHF	SXHF	SEHG	SFHG	SXHG	SAHF	S*HF/G
C20	4650	5000	5270	4860				490	510
C25	4830	5180	5440	5060				490	510
C30	5570	5930	6200	5800				490	510
C40	7290	7820	8280	7650				515	550
C50	8350	8900	9380	8740				515	550
C55	8600	9160	9640	9010				515	550
C60	9840	10150	10620	10010				610	640
C70	10370	10690	11160	10560				610	640
C75	10370	10690	11160	10560				610	640
C90					15460	16050	15240		770
D11					15950	16590	15810		770
D12					16380	17010	16220		770
D13					16730	17380	16580		770

- Note:** 1. The weights shown in this table represents the typical unit operating weights for the heating/cooling function indicated with an economizer and exhaust fan installed.
 2. The weights shown represents the typical unit operating weights for the heating/cooling function indicated with an economizer, exhaust fan with supply & exhaust VFD installed.
 3. Roof curb weights include the curb and pedestal.

Roof Curb and Ductwork

The roof curbs for 20 through 130 Ton units consists of two main components; a pedestal to support the unit's condenser section and a "full perimeter" enclosure to support the unit's air handler section.

Before installing any roof curb, verify;

1. That it is the correct curb for the unit,
2. That it includes the necessary gaskets and hardware,
3. That the purposed installation location provides the required clearance for proper operation.
4. Insure that the curb is level and square. The top surface of the curb must be true to assure an adequate curb-to-unit seal.

Step-by-step curb assembly and installation instructions ship with each Trane accessory roof curb kit. Follow the instructions carefully to assure proper fit-up when the unit is set into place.

Note: To assure proper condensate flow during operation, the unit (and curb) must be as level as possible. The maximum slope allowable for rooftop unit applications, excluding SSH 's, is 4" end-to-end and 2" side-to-side. Units with steam coils (SSH 's) must be set level!

If the unit is elevated, a field constructed catwalk around the unit is strongly recommended to provide easy access for unit maintenance and service.

Recommendations for installing the Supply Air and Return Air ductwork joining the roof curb are included in the curb instruction booklet. Curb ductwork must be fabricated and installed by the installing contractor before the unit is set into place.

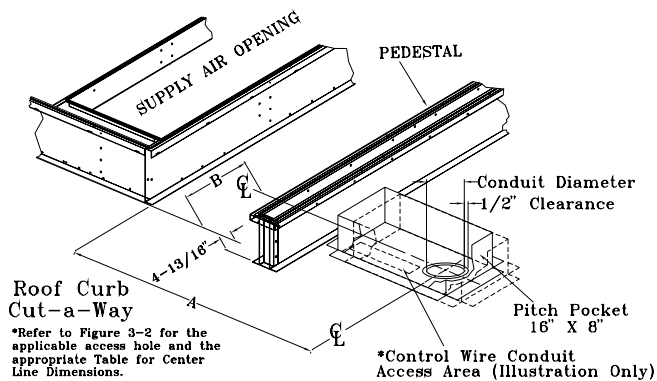
Note: For sound consideration, cut only the holes in the roof deck for the ductwork penetrations. Do not cut out the entire roof deck within the curb perimeter.

Trane's Engineering Bulletin RT-EB-80 provides additional information concerning duct design and sound reduction.

Pitch Pocket Location

The location of the main supply power entry for S_HF 20 through 75 Ton rooftop units is located at the bottom right-hand corner of the control panel. Figures 3-2A, B & C illustrate the location for the electrical entrance through the base in order to enter the control panel. If the power supply conduit penetrates the building's roof beneath this opening, it is recommended that a pitch pocket be installed before the unit is placed onto the roof curb. The center line dimensions shown in the illustration below indicates the center line of the electrical access hole in the unit base when it is positioned on the curb, $\pm 3/8$ inch. The actual diameter of the hole in the roof should be at least 1/2 inch larger than the diameter of the conduit penetrating the roof. This will allow for the clearance variable between the roof curb rail and the unit base rail illustrated in Figure 3-5.

The pitch pocket dimensions listed are recommended to enhance the application of roofing pitch after the unit is set into place. The pitch pocket may need to be shifted as illustrated to prevent interference with the curb pedestal.



Unit	Tonnage	"A" Dimension	"B" Dimension
S*HF	20, 25 & 30	4' 5-9/16"	5-9/16"
S*HF	50 & 55	9' 5-11/16"	5-1/2"
S*HF	40, 60, 70 & 75	6' 9-5/8"	7-3/16"

* = All unit functions (SAHF, SEHF, SFHF, SSHF, SLHF and SXHF)

If a Trane Curb Accessory Kit is not used:

- The ductwork can be attached directly to the factory-provided flanges around the unit's supply and return air openings. Be sure to use flexible duct connections at the unit.
- For "built-up" curbs supplied by others, gaskets must be installed around the curb perimeter flange and the supply and return air opening flanges.

Installation (Continued)

Note: If a "built-up" curb is provided by others, keep in mind that these commercial rooftop units do not have base pans in the condenser section.

Note: If this is a REPLACEMENT UNIT keep in mind that the CURRENT DESIGN commercial rooftop units do not have base pans in the condenser section.

Unit Rigging & Placement

WARNING Heavy Objects!

Do not use cables (chains or slings) except as shown. Each of the cables (chains or slings) used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements may cause equipment or property-only damage. Failure to properly lift unit may result in death or serious injury. See details below.

Note: Use spreader bars as shown in the diagram. Refer to the Installation manual or nameplate for the unit weight. Refer to the Installation Instructions located inside the side control panel for further rigging information.

- A Center-of-Gravity illustration and the dimensional data is shown in Figure 3-3.
- Attach adequate strength lifting slings to all four lifting lugs on 20 through 75 Ton units and to all six lifting lugs on 90 through 130 Ton units. The minimum distance between the lifting hook and the top of the unit should be 7 feet for 20 through 75 Ton units and 12 feet for 90 through 130 Ton units. Figure 3-4 illustrates the installation of spreader bars to protect the unit and to facilitate a uniform lift. Table 3-3 list the typical unit operating weights.
- Test-lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments.
- Lift the unit and position it over the curb and pedestal. (These units have a continuous base rail around the air handler section which matches the curb.
- Align the base rail of the unit's air handler section with the curb rail while lowering the unit onto the curb. Make sure that the gasket on the curb is not damaged while positioning the unit. (The pedestal simply supports the unit's condenser section)

A cross section of the juncture between the unit and the roof curb is shown in Figure 3-5.

Figure 3-4
Typical Unit Rigging

Typical 90 through 130 Ton Unit

Typical 20 through 75 Ton Unit

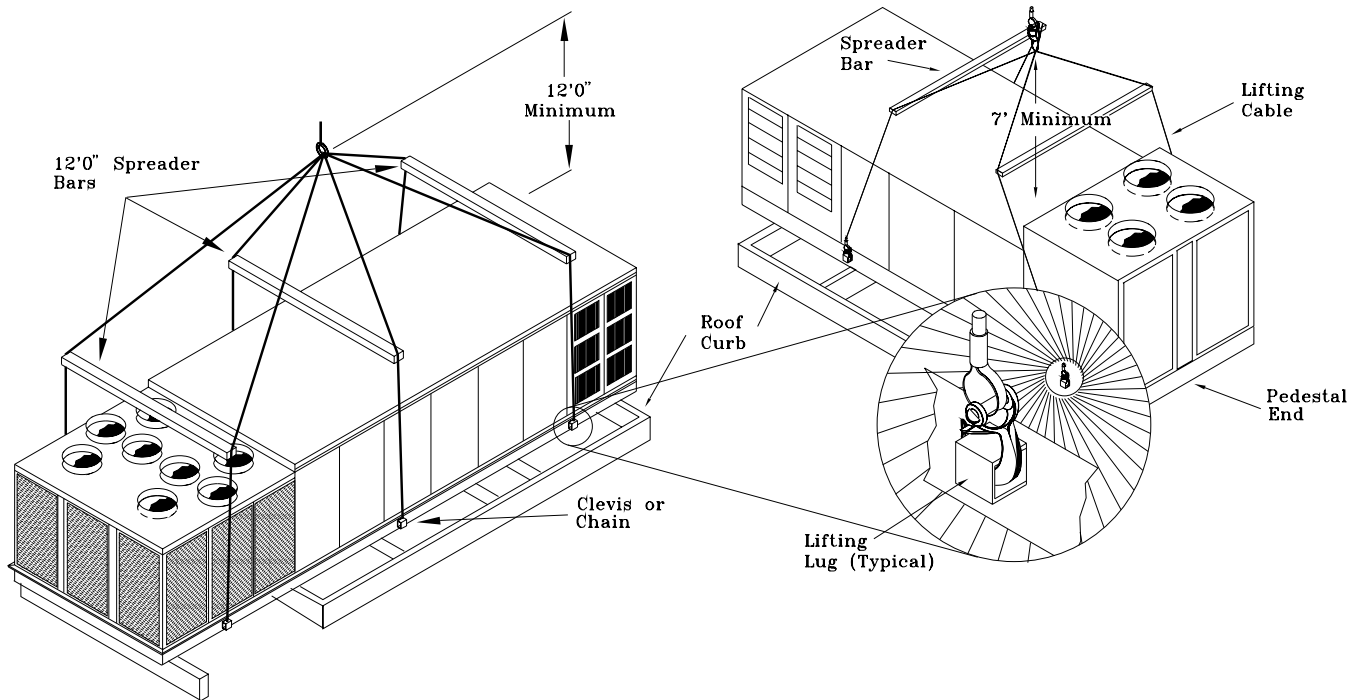
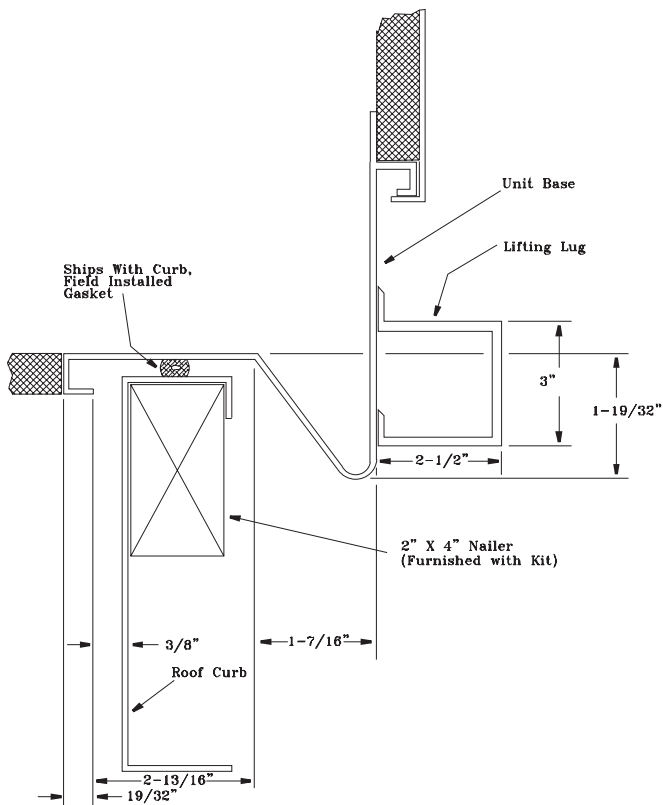


Figure 3-5
Unit Base & Roof Curb Section



General Unit Requirements

The checklist listed below is a summary of the steps required to successfully install a Commercial rooftop unit. This checklist is intended to acquaint the installing personnel with what is required in the installation process. It does not replace the detailed instructions called out in the applicable sections of this manual.

- [] Check the unit for shipping damage and material shortage; file a freight claim and notify Trane office.
- [] Verify that the installation location of the unit will provide the required clearance for proper operation.
- [] Assemble and install the roof curb. Refer to the current edition of SAHF-IN-5 for 20 through 75 Ton units or SXHG-IN-2 for 90 through 130 Ton units.
- [] Fabricate and install ductwork; secure ductwork to curb.
- [] Install pitch pocket for power supply through building roof. (If applicable)
- [] Rigging the unit.
- [] Set the unit onto the curb; check for levelness.
- [] Ensure unit-to-curb seal is tight and without buckles or cracks.
- [] Install and connect condensate drain lines to each evaporator drain connection.
- [] Remove the shipping hardware from each compressor assembly.
- [] Remove the shipping hold-down bolts and shipping channels from the supply and exhaust fans ordered with rubber or spring isolators.
- [] Check all optional supply and exhaust fan spring isolators for proper adjustment.
- [] Verify that all plastic coverings are removed from the compressors.
- [] Verify all discharge and liquid line service valves (one per circuit) are back seated.

Main Electrical Power Requirements

- [] Verify that the power supply complies with the unit nameplate specifications.
- [] Inspect all control panel components; tighten any loose connections.
- [] Connect properly sized and protected power supply wiring to a field-supplied/installed disconnect and unit
- [] Properly ground the unit.

Note: All field-installed wiring must comply with NEC and applicable local codes.

Installation (Continued)

Field Installed Control Wiring

- [] Complete the field wiring connections for the constant volume controls as applicable. Refer to "Field Installed Control Wiring" for guidelines.
- [] Complete the field wiring connections for the variable air volume controls as applicable. Refer to "Field Installed Control Wiring" for guidelines.

Note: All field-installed wiring must comply with NEC and applicable local codes.

Requirements for Electric Heat Units

All SEHF Units (380 minimum voltage) & SEHG units.

- [] Verify that the power supply complies with the electric heater specifications on the unit and heater nameplate.
- [] Inspect the heater junction box and control panel; tighten any loose connections.
- [] Check electric heat circuits for continuity.

SEHF Units w/200V or 230V Electric Heat: (Requires Separate Power Supply to Heater)

- [] Connect properly sized and protected power supply wiring for the electric heat from a dedicated, field-supplied/installed disconnect to terminal block 4TB2, or to an optional unit mounted disconnect switch 4S15.

Requirements for Gas Heat

- [] Gas supply line properly sized and connected to the unit gas train.
- [] All gas piping joints properly sealed.
- [] Drip leg Installed in the gas piping near the unit.
- [] Gas piping leak checked with a soap solution. If piping connections to the unit are complete, do not pressurize piping in excess of 0.50 psig or 14 inches w.c. to prevent component failure.
- [] Main supply gas pressure adequate.
- [] Flue Tubes clear of any obstructions.
- [] Factory-supplied flue assembly installed on the unit.
- [] Connect the 3/4" CPVC furnace drain stubout to a proper condensate drain.

Requirements for Hot Water Heat (SLH_)

- [] Route properly sized water piping through the base of the unit into the heating section.
- [] Install the factory-supplied, 3-way modulating valve.
- [] Complete the valve actuator wiring.

Installation (Continued)

Requirements for Steam Heat (SSH_)

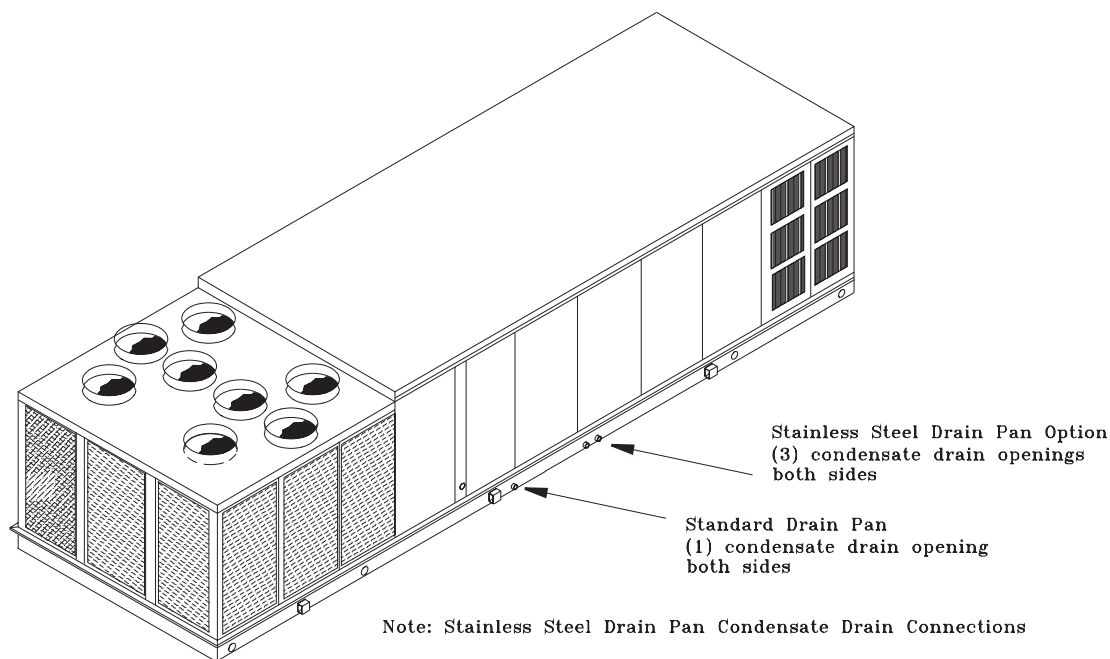
- [] Install an automatic air vent at the top of the return water coil header.
- [] Route properly sized steam piping through the base of the unit into the heating section.
- [] Install the factory-supplied, 2-way modulating valve
- [] Complete the valve actuator wiring.
- [] Install 1/2", 15-degree swing-check vacuum breaker(s) at the top of each coil section. Vent breaker(s) to atmosphere or merge with return main at discharge side of steam trap.
- [] Position the steam trap discharge at least 12" below the outlet connection on the coil.

- [] Use float and thermostatic traps in the system, as required by the application.

O/A Pressure Sensor and Tubing Installation (All units with Statitrac)

- [] O/A pressure sensor mounted to the roof bracket.
- [] Factory supplied pneumatic tubing installed between the O/A pressure sensor and the connector on the vertical support.
- [] Field supplied pneumatic tubing connected to the proper fitting on the space pressure transducer located in the filter section, and the other end routed to a suitable sensing location within the controlled space.

Figure 3-6A
Condensate Drain Locations



Note: Stainless Steel Drain Pan Condensate Drain Connections

When unit has optional stainless steel drain pan, connect all 3 drains on each side of the unit (total 6) to the trapped condensate drain.

Each drain pan connection must be trapped. The drains may be trapped individually or connected and then trapped.

Condensate Drain Connections

Each S_HF unit is provided with two or six 1" evaporator condensate drain connections (one on each side of the unit). Each S_HG unit is provided with two or six 1-1/4" evaporator drain connections (one on each side of the unit.)

Due to the size of these units, all condensate drain connection must be connected to the evaporator drain connections. Refer to the appropriate illustration in Figure 3-2 for the location of these drain connections.

A condensate trap must be installed due to the drain connection being on the "negative pressure" side of the fan. Install the P-Traps at the unit using the guidelines in Figure 3-6.

Pitch the drain lines at least 1/2 inch for every 10 feet of horizontal run to assure proper condensate flow. Do not allow the horizontal run to sag causing a possible double-trap condition which could result in condensate backup due to "air lock".

Units with Gas Furnace

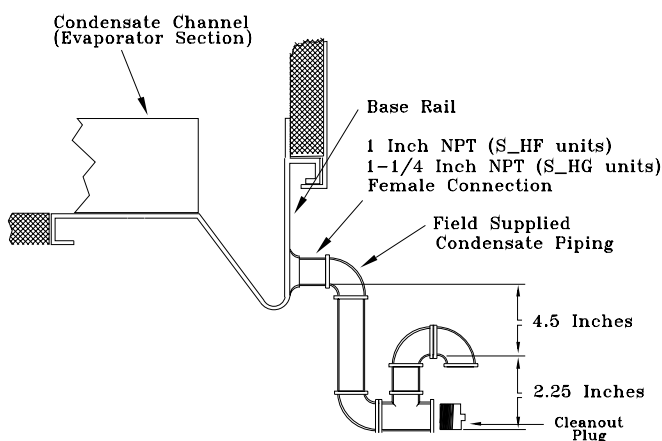
Units equipped with a gas furnace have a 3/4" CPVC drain connection stubbed out through the vertical support in the gas heat section. It is extremely important that the condensate be piped to a proper drain. Refer to the appropriate illustration in Figure 3-2 for the location of the drain connection.

Note: Units equipped with an optional modulating gas furnace will likely operate in a condensing mode part of the time.

An additional 1-1/4" non-connectable water drain is located in the base rail within the heating section.

Ensure that all condensate drain line installations comply with applicable building and waste disposal codes.

Figure 3-6
Condensate Trap Installation
Shipping Fasteners



Removing Compressor Assembly Shipping Hardware (20 through 60 Ton)

Each manifolded compressor assembly is rigidly bolted to a mounting rail assembly. The rail assembly sets on four (4) rubber isolators. The assembly is held in place by two shipping braces that secure each compressor rail assembly to

Installation (Continued)

the unit's base rail. To locate and remove the shipping hardware, refer to Figure 3-7 and the following procedure.

1. Remove the four anchor bolts (2 front and 2 rear), used to secure the shipping brace to the unit's base rail (two assemblies on 40 through 60 Ton units).
2. Remove the three self-tapping screws that secure each shipping brace to the compressor mounting rails.
3. Remove and discard the two 30-1/2" long shipping braces for each assembly.
4. Do not remove the shipping bracket located on top of the compressors.
5. Ensure that the compressor rail assembly is free to move on the rubber isolators.

Removing Compressor Assembly Shipping Hardware (70 & 105 Ton)

Each manifolded compressor assembly is rigidly bolted to a mounting rail assembly. The rail assembly sets on six (6) rubber isolators. The assembly is held in place by four (4) shipping "Tiedown" bolts. To remove the shipping hardware, follow the procedures below:

1. At each "Tiedown" location (2 front and 2 rear), remove and discard the tiedown bolt and the slotted shipping spacer located between the compressor rails and the unit base rail illustrated in Figure 3-7B, "Tiedown Bolt" detail.
2. Remove the bolt in each rubber isolator and the slotted shipping spacer located between the compressor rails and the unit base rail illustrated in Figure 3-7B, "Isolator Bolt" detail. Reinstall the bolts at the same location by screwing them into the base rail two to three turns only.
3. Ensure that the compressor rail assembly is free to move on the rubber isolators.

Removing Compressor Assembly Shipping Hardware (115 and 130 Ton)

Each manifolded compressor assembly is rigidly bolted to a mounting rail assembly. The rail assembly sets on eight (8) rubber isolators. The assembly is held in place by six (6) "Tiedown Bolts". To remove the shipping hardware, follow the procedure below:

1. At each "Tiedown" location (6), remove and discard the tiedown bolt and the slotted shipping spacer located between the compressor rails and the unit base rail illustrated in Figure 3-7C, "Tiedown Bolt" detail.
2. Remove the bolt in each rubber isolator and the slotted shipping spacer located between the compressor rails and the unit base rail illustrated in Figure 3-7C, "Isolator Bolt" detail. Reinstall the bolts at the same location by screwing them into the base rail two to three turns only.
3. Ensure that the compressor rail assembly is free to move on the rubber isolators.

Figure 3-7A
 Removing Scroll Compressor Shipping Hardware for 20 through 60 Ton Units

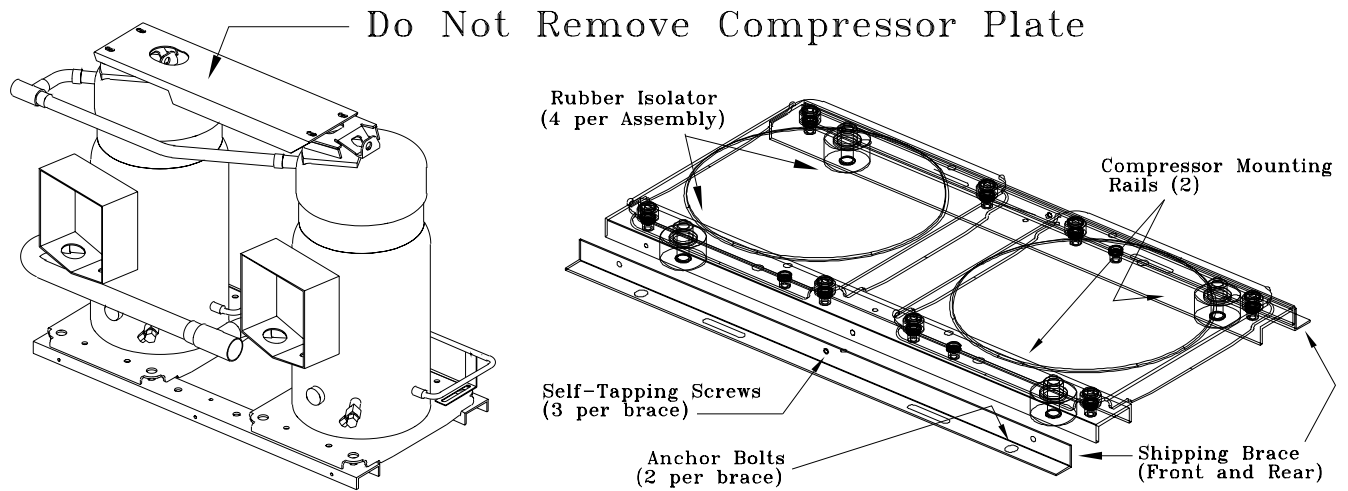


Figure 3-7B
 Removing Scroll Compressor Shipping Hardware for 70 through 105 Ton Units

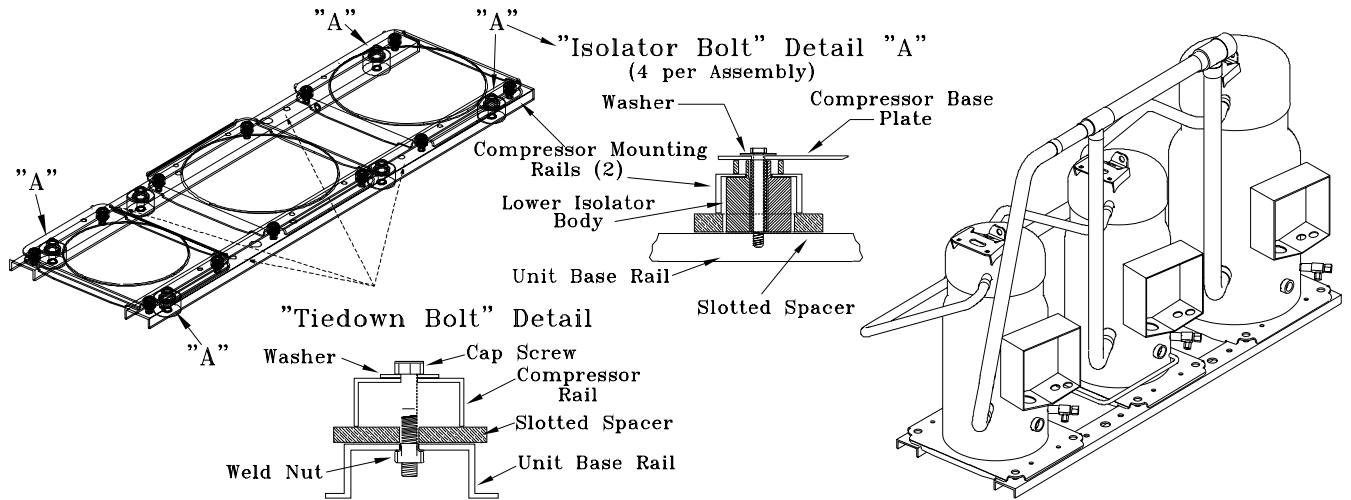
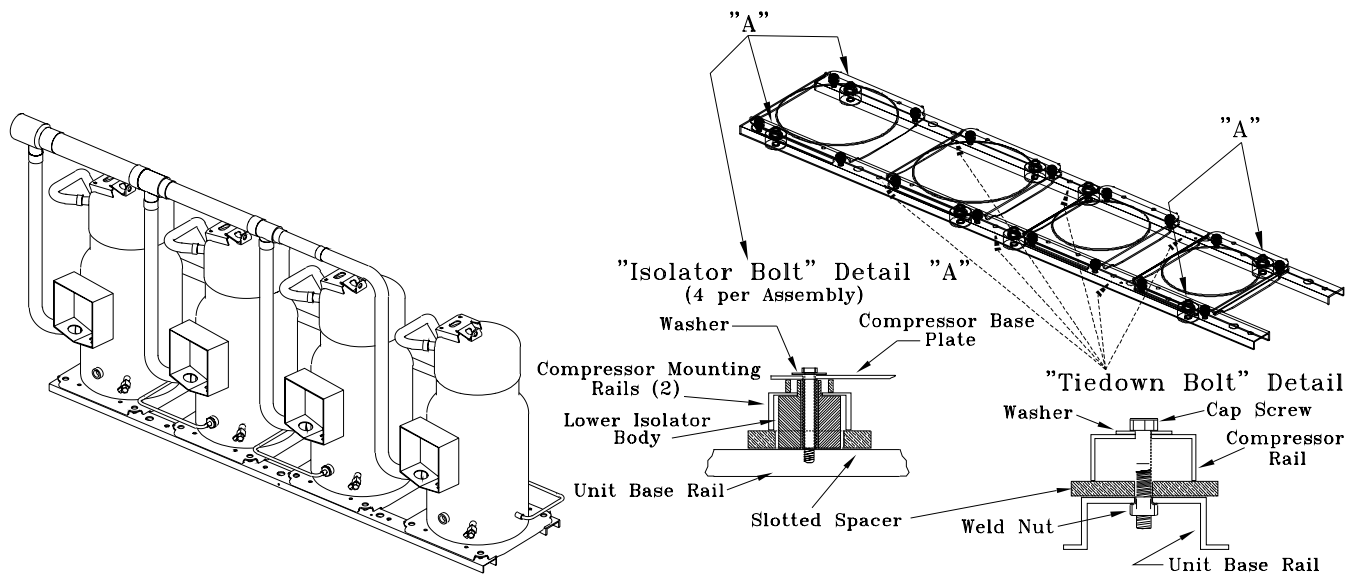


Figure 3-7C
 Removing Scroll Compressor Shipping Hardware for 115 and 130 Ton Units



Installation (Continued)

Removing Supply and Exhaust Fan Shipping Channels (Motors >5Hp)

Each supply fan assembly and exhaust fan assembly for S_HF units shipped with a motor larger than 5 HP is equipped with rubber isolators, (as standard), or optional spring isolators. Each supply fan assembly and exhaust fan assembly for S_HG units is equipped with spring isolators. Shipping channels are installed beneath each fan assembly and must be removed. To locate and remove these channels, refer to Figure 3-8 and use the following procedures.

Rubber Isolators:

1. Remove and discard the shipping bolts from the fan assembly rails.

2. Elevate the fan-and-motor assembly and slide the shipping channels out from between the fan assembly rails and the unit's base rail.
3. Lower the fan-and-motor assembly onto the isolators. Make sure that the pins at the top of the isolators are engaged in the corresponding holes on the fan assembly.
4. Verify that the fan assembly is being supported by the isolators.

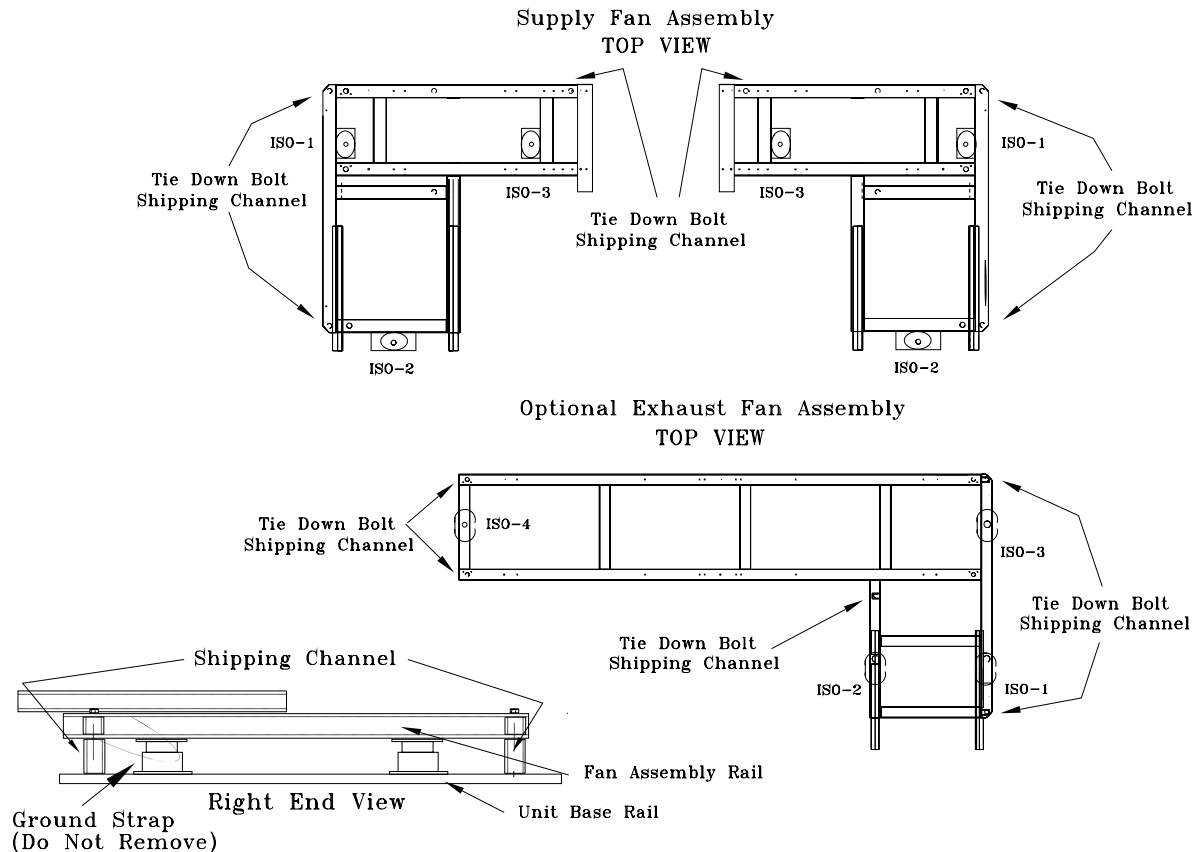
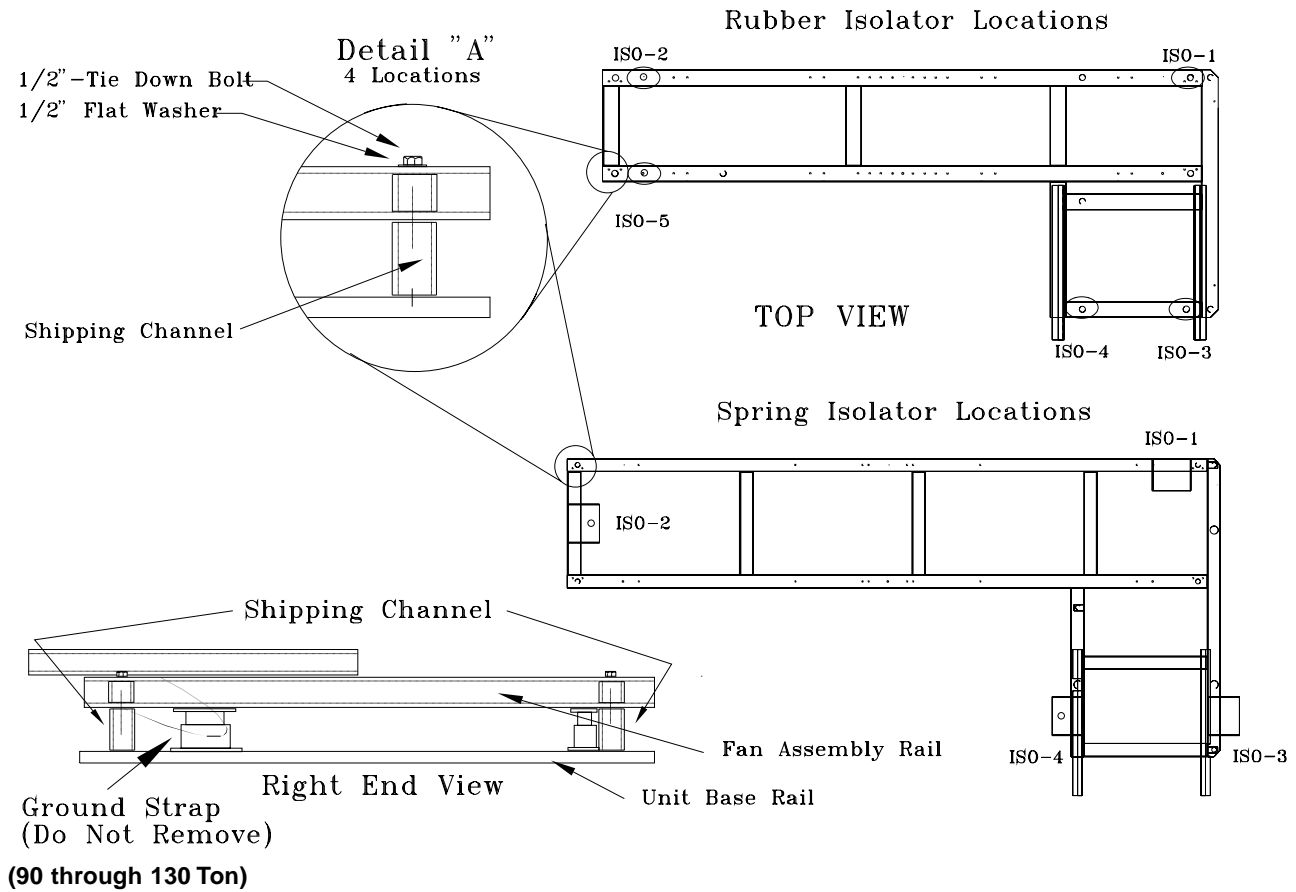
Spring Isolators:

Spring isolators for the supply and/or exhaust fan are shipped with the isolator adjusting bolt backed out. Field adjustment is required for proper operation. Figure 3-8 shows isolator locations. To adjust the spring isolators use the following procedure.

1. Remove and discard the shipping tie down bolts but leave the shipping channels in place during the adjustment procedure. See Figure 3-8.
2. Tighten the leveling bolt on each isolator until the fan assembly is approximately 1/4" above each shipping channel.
3. Secure the lock nut on each isolator.
4. Remove the shipping channels and discard.

Figure 3-8
Removing Fan Assembly Shipping Hardware (20 through 75 Ton)

Note: Fan assemblies not equipped with rubber or spring isolators have mounting bolts at the same locations and must not be removed.



O/A Sensor & Tubing Installation

An Outside Air Pressure Sensor is shipped with all units designed to operate on variable air volume applications or constant volume units with 100% modulating exhaust w/ Stratitrac.

On VAV systems, a duct pressure transducer (3U60) and the outside air sensor is used to control the discharge duct static pressure to within a customer-specified parameter.

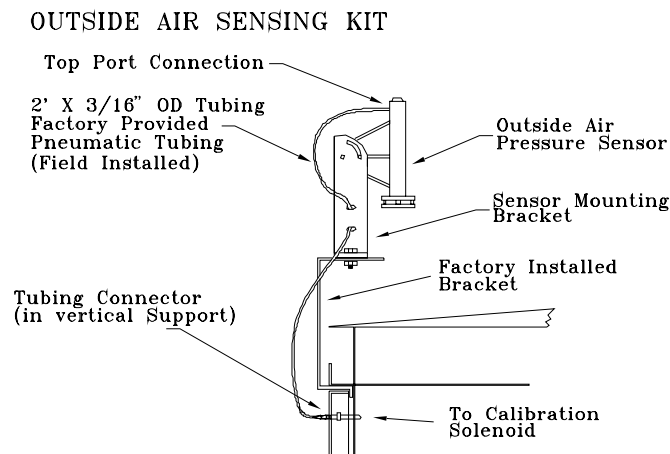
On CV & VAV units equipped with 100% modulating exhaust w/Stratitrac, a space pressure transducer (3U62) and the outside air sensor is used to control the exhaust fan and dampers to relieve static pressure, to within a customer-specified parameter, within the controlled space. Refer to Figure 3-9 and the following steps to install the sensor and the pneumatic tubing.

1. Remove the O/A pressure sensor kit located inside the filter section. The kit contains the following items;
 - O/A static pressure sensor with sensor mounting bracket
 - 2' of 3/16" O.D. pneumatic tubing
 - Mounting hardware
2. Using two #10-32 x 1-3/4" screws provided, install the sensor's mounting bracket to the factory installed bracket (near the filter section).
3. Using the #10-32 x 1/2" screws provided, install the O/A static pressure sensor vertically to the sensor bracket.
4. Remove the dust cap from the tubing connector located below the sensor in the vertical support.
5. Attach one end of the 2' x 3/16" O.D. factory provided pneumatic tubing to the sensor's top port, and the other end of the tubing to the connector in the vertical support. Discard any excess tubing.

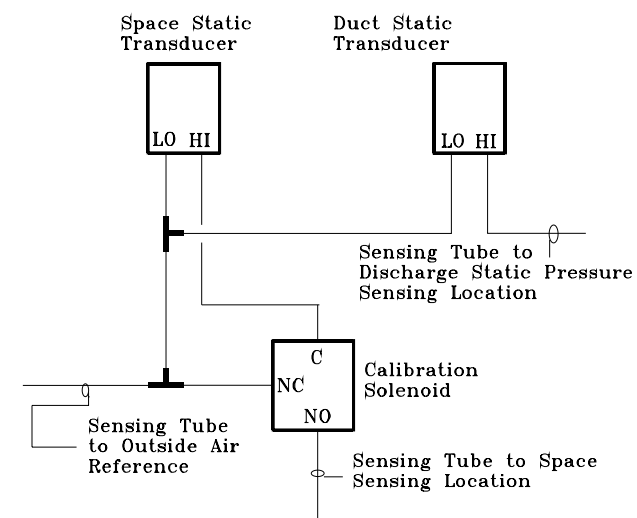
Units with Statitrac™:

6. Open the filter access door, and locate the DSP control devices illustrated in Figure 3-9. There are three tube connectors mounted on the left of the solenoid and transducers. Connect one end of the field provided 3/16" O.D. pneumatic tubing for the space pressurization control to the bottom fitting. Route the opposite end of the tubing to a suitable location inside the building. This location should be the largest open area that will not be affected by sudden static pressure changes.

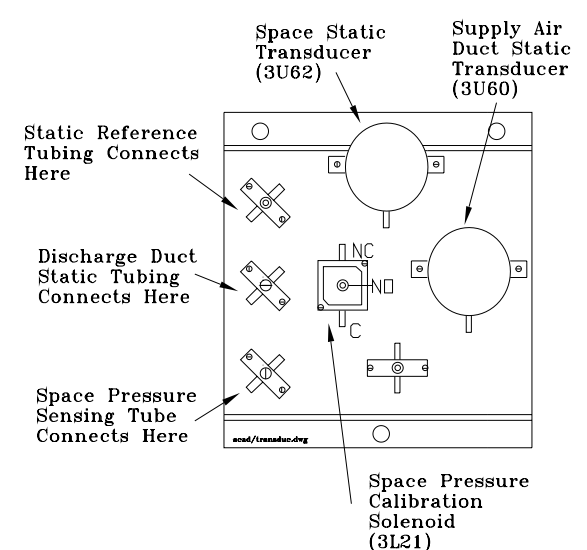
Figure 3-9



DUCT & SPACE PRESSURE TRANSDUCER TUBING SCHEMATIC



DUCT & SPACE STATIC PRESSURE CONTROL COMPONENT LAYOUT



Gas Heat Units (SFH_)

All internal gas piping is factory-installed and pressure leak-tested before shipment. Once the unit is set into place, the gas supply line must be field-connected to the elbow located inside the gas heat control compartments.



WARNING **Hazardous Gases and Flammable Vapors!**

Exposure to hazardous gases from fuel substances have been shown to cause cancer, birth defects or other reproductive harm. Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures. To avoid hazardous gases and flammable vapors follow proper installation and set up of this product and all warnings as provided in this manual. Failure to follow all instructions could result in death or serious injury.

When using dry nitrogen cylinders for pressurizing units for leak testing, always provide a pressure regulator on the cylinder to prevent excessively high unit pressures. Never pressurize unit above the maximum recommended unit test pressure as specified in applicable unit literature. Failure to properly regulate pressure could result in a violent explosion, which could result in death or serious injury or equipment or property-only-damage. (add when appropriate: See maximum recommended unit test pressure below.)

Access holes are provided on the unit as illustrated in Figure 3-2B to accommodate a side or bottom pipe entry on 20 through 75 Ton units and Figure 3-2C for bottom entry on 90 through 130 Ton units. Following the guidelines listed below will enhance both the installation and operation of the furnace.

Note: In the absence of local codes, the installation must conform with the American National Standard Z223-1a of the National Fuel Gas Code, (latest edition).

1. To assure sufficient gas pressure at the unit, use Table 3-4 as a guide to determine the appropriate gas pipe size for the unit heating capacity listed on the unit's nameplate.
2. If a gas line already exist, verify that it is sized large enough to handle the additional furnace capacity before connecting to it.
3. Take all branch piping from any main gas line from the top at 90 degrees or at 45 degrees to prevent moisture from being drawn in with the gas.
4. Ensure that all piping connections are adequately coated with joint sealant and properly tightened. Use a piping compound that is resistant to liquid petroleum gases.
5. Provide a drip leg near the unit.

Installation (Continued)

6. Install a pressure regulator at the unit that is adequate to maintain 7" w.c. for natural gas while the furnace is operating at full capacity.

Note: Gas pressure in excess of 14" w.c. or 0.5 psig will damage the gas train.

Failure to use a pressure regulating device will result in incorrect gas pressure. This can cause erratic operation due to gas pressure fluctuations as well as damage the gas valve.

Over sizing the regulator will cause irregular pulsating flame patterns, burner rumble, potential flame outages, and possible gas valve damage.

If a single pressure regulator serves more than one rooftop unit, it must be sized to ensure that the inlet gas pressure does not fall below 7" w.c. with all the furnaces operating at full capacity. The gas pressure must not exceed 14" w.c. when the furnaces are off.

7. Provide adequate support for all field installed gas piping to avoid stressing the gas train and controls.
8. Leak test the gas supply line using a soap-and-water solution or equivalent before connecting it to the gas train.
9. Check the supply pressure before connecting it to the unit to prevent possible gas valve damage and the unsafe operating conditions that will result.

Note: Do not rely on the gas train shutoff valves to isolate the unit while conducting gas pressure/leak test. These valves are not designed to withstand pressures in excess of 14" w.c. or 0.5 psig.

Connecting the Gas Supply Line to the Furnace Gas Train

Follow the steps below to complete the installation between the supply gas line and the furnace. Refer to Figure 3-10 for the appropriate gas train configuration.

1. Connect the supply gas piping using a "ground-joint" type union to the furnace gas train and check for leaks.
2. Adjust the inlet supply pressure to the recommended 7" to 14" w.c. parameter for natural gas.
3. Ensure that the piping is adequately supported to avoid gas train stress.

Installation (Continued)

Table 3-4
Sizing Natural Gas Pipe Mains & Branches
Sizing Natural Gas Pipe Mains & Branches

Gas Supply Pipe Run (ft)	Gas Input (Cubic Feet/Hour)*					
	1-1/4" Pipe	1-1/2" Pipe	2" Pipe	2-1/2" Pipe	3" Pipe	4" Pipe
10	1050	1600	3050	4800	8500	17500
20	730	1100	2100	3300	5900	12000
30	590	890	1650	2700	4700	9700
40	500	760	1450	2300	4100	8300
50	440	670	1270	2000	3600	7400
60	400	610	1150	1850	3250	6800
70	370	560	1050	1700	3000	6200
80	350	530	990	1600	2800	5800
90	320	490	930	1500	2600	5400
100	305	460	870	1400	2500	5100
125	275	410	780	1250	2200	4500
150	250	380	710	1130	2000	4100
175	225	350	650	1050	1850	3800
200	210	320	610	980	1700	3500

* Table is based on a specific gravity of 0.60. Use Table 3-1 for specific gravity of the local gas supply.

Notes:

1. If more than one unit is served by the same main gas supply, consider the total gas input (cubic feet/hr.) and the total length when determining the appropriate gas pipe size.
2. Obtain the Specific Gravity and BTU/Cu.Ft. from the gas company.
3. The following example demonstrates the considerations necessary when determining the actual pipe size.

Example: A 40' pipe run is needed to connect a unit with a 500 MBH furnace to a natural gas supply having a rating of 1,000 BTU/Cu.Ft. and a specific gravity of 0.60

$$\text{Cu.Ft./Hour} = \frac{\text{Furnace MBH Input}}{\text{Gas BTU/Cu.Ft.} \times \text{Multiplier (Table 3-1)}}$$

$$\text{Cu.Ft./Hour} = 500$$

Table 3 indicates that a 1-1/4" pipe is required.

Specific Gravity Multipliers

Specific Gravity	Multiplier
0.50	1.10
0.55	1.04
0.60	1.00
0.65	0.96

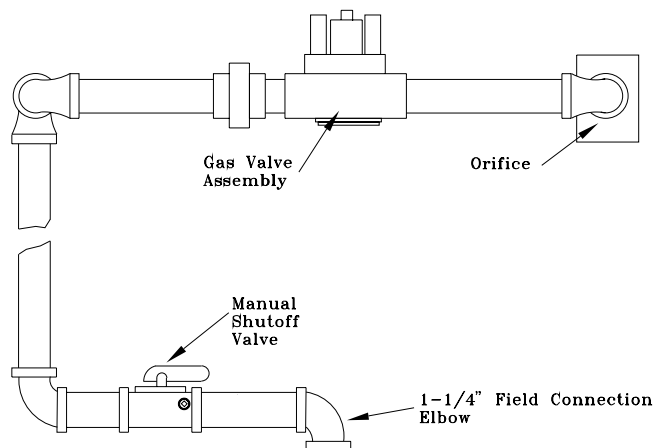
Gas Heating Capacity Altitude Correction Factors

Capacity Multiplier	Altitude (Ft.)						
	Sea Level To 2000	2001 To 2500	2501 To 3500	3501 To 4500	4501 To 5500	5501 To 6500	6501 To 7500
	1.00	.92	.88	.84	.80	.76	.72

Note: Correction factors are per AGA Std. 221.30 - 1964, Part VI, 6.12. Local codes may supersede.

Figure 3-10
Unit Gas Trains (Natural Gas)

235 and 350 MBH



500 and 850 MBH

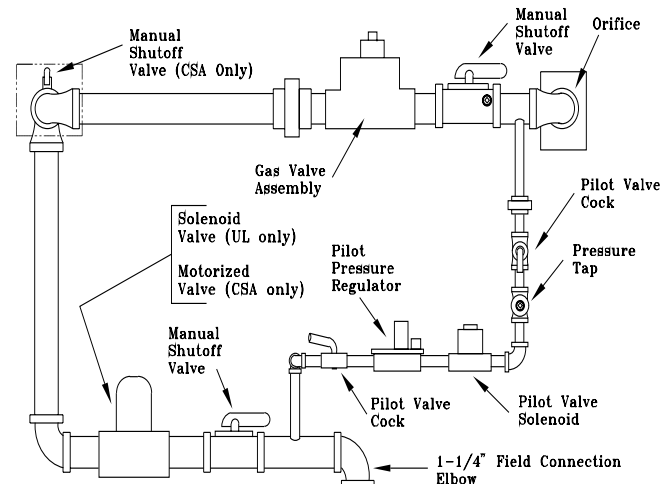
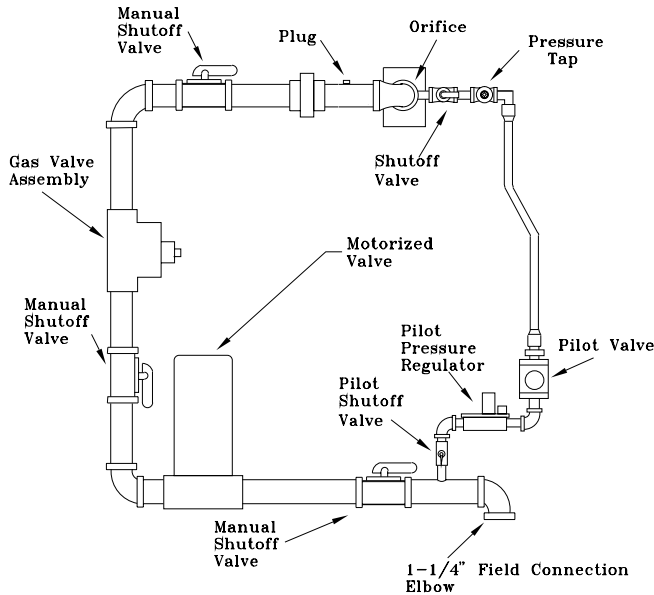
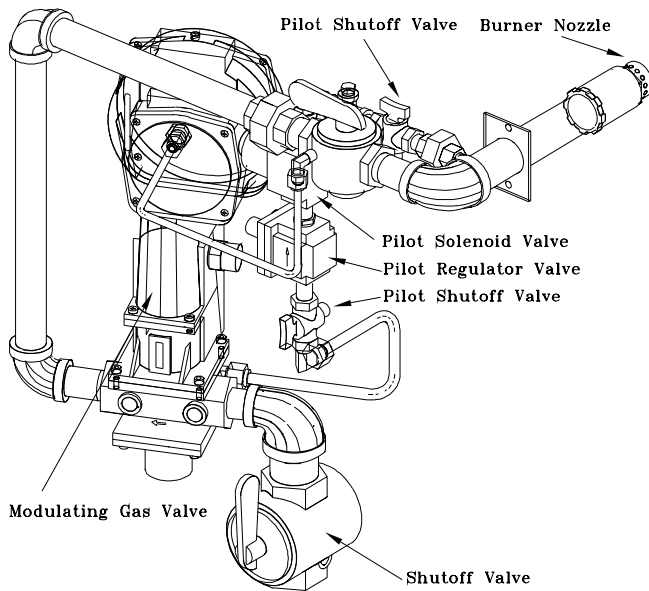


Figure 3-10 (Continued)
Unit Gas Trains (Natural Gas)

1000 MBH



Modulating (500 MBH - 1000 MBH)



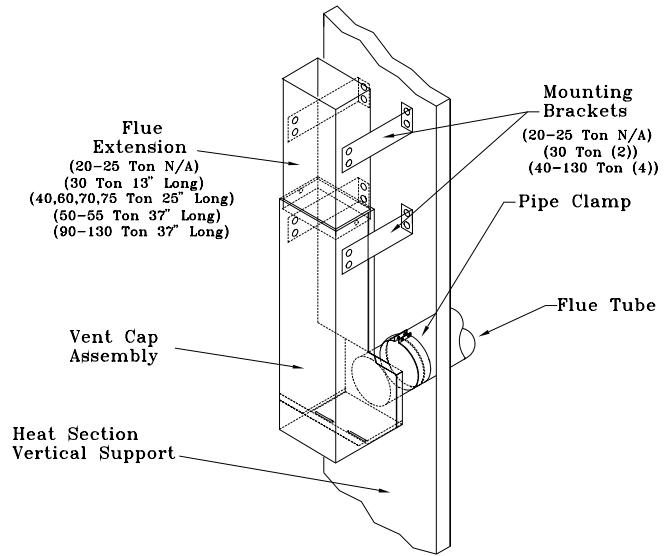
Flue Assembly Installation

1. Locate the flue assembly and the extension (refer to Figure 3-11 for extension usage) in the shipwith section of the unit.
2. Install the flue extension onto the flue assembly as shown in Figure 3-11.
3. Slide the pipe clamp onto the heater flue tube located inside the heater compartment.

Installation (Continued)

4. Insert the tube on the flue assembly into the hole located in the vertical support for the heat section.
5. Butt both flue tube sections together and center the pipe clamp over joint.
6. Using the pre-punch holes in the flue assembly, extension, and the vertical support, install the appropriate number of mounting brackets. Refer to Figure 3-11 for details.

Figure 3-11
Flue Assembly



Hot Water Heat Units (SLH_)

Hot water heating coils are factory installed inside the heater section of the unit. Once the unit is set into place, the hot water piping and the factory provided three way modulating valve must be installed. The valve can be installed inside the heat section or near the unit. If the valve is installed in a remote location, use field supplied wiring to extend the control wires from the heater section to the valve. Two access holes are provided in the unit base as illustrated in Figure 3-2.

Following the guidelines listed below will enhance both the installation and operation of the "wet heat" system. Figure 3-12 illustrates the recommended piping configuration for the hot water coil. Table 3-5 list the coil connection sizes.

Note: The valve actuators are not waterproof. Failure to protect the valve from moisture may result in the loss of heating control.

1. Support all field-installed piping independently from the heating coil.
2. Use swing joints or flexible connectors adjacent to the heating coil. (These devices will absorb the strains of expansion and contraction).
3. All return lines and fittings must be equal to the diameter of the "outlet" connection on the hot water coil.

4. Install a "Gate" type valve in the supply branch line as close as possible to the hot water main and upstream of any other device or takeoff.
5. Install a "Gate" type valve in the return branch line as close as possible to the return main and down stream of any other device.
6. Install a strainer in the hot water supply branch as shown in Figure 3-12.
7. Install the 3-way valve in an upright position, piped for valve seating against the flow. Ensure that the valve's location lends itself to serviceability.
8. The Type "W" hot water coil used in SLHF units is self-venting only when the tube water velocity exceeds 1.5 feet per second (fps). If the tube velocity is less than 1.5 feet per second, either:
 - a. install an automatic air vent at the top of the return header, using the tapped pipe connection;
 - or,
 - b. vent the coil from the top of the return header down to the return piping. At the vent connection, size the return piping to provide sufficient water velocity.
9. Install a "Globe" type valve in the Bypass line as shown in Figure 3-12.

Table 3-5
Connection Sizes for Hot Water & Steam Coil
 (See Note 1)

Unit Model and Size	Heat Section Capacity (Note 2)	Coil Connections (diameter in inches)	
		Supply	Return
SLH*-20 to 130	High or Low Heat	2-1/2"	2-1/2"
SSHF-20 to 30	High or Low Heat	3"	1-1/4"
SSHF-40 to 75 (Note 3)	High Heat	3"	1-1/2"
SSHG-90 to 130	Low Heat (Note 3)	1-1/2"	1"

Notes:

1. Type W coils—with center offset headers—are used in SLH_ units; Type NS coils are used in SSH_ units.
2. See Digit 9 of the unit model number to determine the heating capacity.
3. SSH_ - 40 to 130 Ton units have multiple headers.

Steam Heat Units (SSH_)

Steam heating coils are factory installed inside the heater section of the unit. The coils are pitched, within the units, to provide the proper condensate flow from the coil. To maintain the designed degree of pitch for the coil, the unit must be level.

Once the unit is set into place, the steam piping and the factory provided two way modulating valve must be installed. The valve can be installed inside the heater section or near the unit. If the valve is installed in a remote location,

Installation (Continued)

use field supplied wiring to extend the control wires from the heater section to the valve. Two access holes are provided in the unit base as illustrated in Figure 3-2.

Following the guidelines listed below will enhance both the installation and operation of the "wet heat" system. Figure 3-13 illustrates the recommended piping configurations for the steam coil. Table 3-5 list the coil connection sizes.

Note: The valve actuators are not waterproof. Failure to protect the valve from moisture may result in the loss of heating control.

1. Support all field-installed piping independently from the heating coil.
2. Use swing joints or flexible connectors adjacent to the heating coil. (These devices will absorb the strains of expansion and contraction.)
3. Install the 2-way valve in an upright position. Ensure that the valve's location lends itself to serviceability.
4. Pitch the supply and return steam piping downward 1" per 10' of run in the direction of flow.
5. All return lines and fittings must be equal to the diameter of the "outlet" connection on the steam coil(s). If the steam trap connection is smaller than the coil "outlet" diameter, reduce the pipe size between the strainer and the steam trap connections only.
6. Install a 1/2" 15 degree swing-check vacuum breaker at the top of the return coil header using the tapped pipe connection. Position the vacuum breaker as close to the coil as possible.

Note: Vacuum breakers should have extended lines from the vent ports to the atmosphere or connect each vent line to the return pipe on the discharge side of the steam traps.

7. Install a "Gate" type valve in the supply branch line as close as possible to the steam main and upstream of any other device.
8. Install a "Gate" type valve in the return branch line as close as possible to the condensate return main and downstream of any other device.
9. Install a strainer as close as possible to the inlet of the control valve and steam trap(s).
10. Steam trap selection should be based on the maximum possible condensate flow and the recommended load factors.
11. Install a Float-and-Thermostatic (FT) type trap to maintain proper flow. They provide gravity drains and continuous discharge operation. FT type traps are required if the system includes either;
 - a. an atmospheric pressure/gravity condensate return;
 - or,
 - b. a potentially low pressure steam supply.

Installation (Continued)

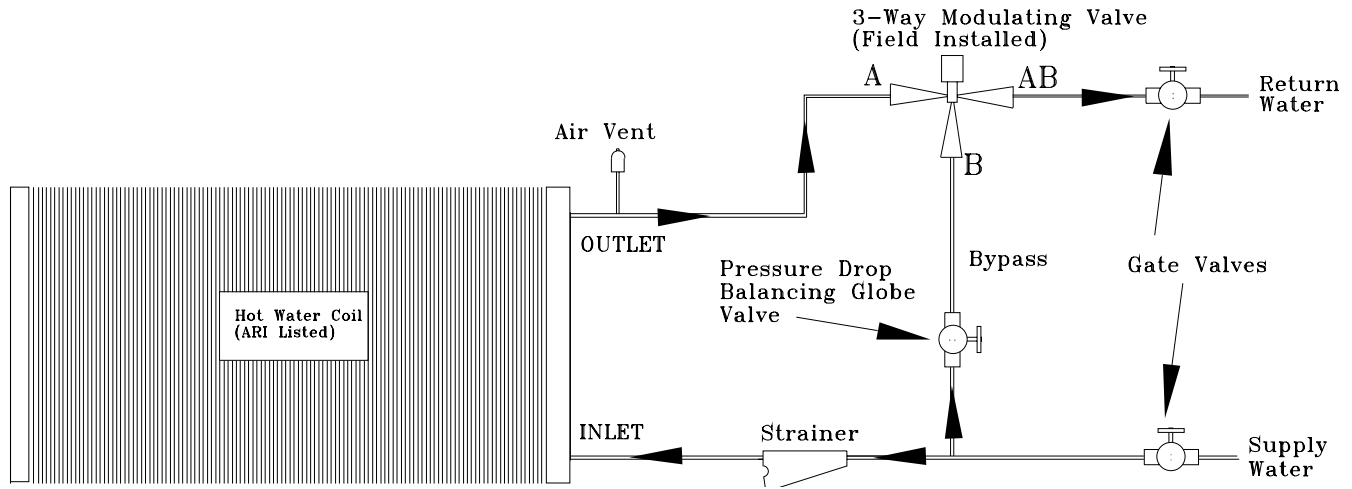
12. Position the outlet or discharge port of the steam trap at least 12" below the outlet connection on the coil(s). This will provide adequate hydrostatic head pressure to overcome the trap losses and assure complete condensate removal.

40 through 130 Ton units;

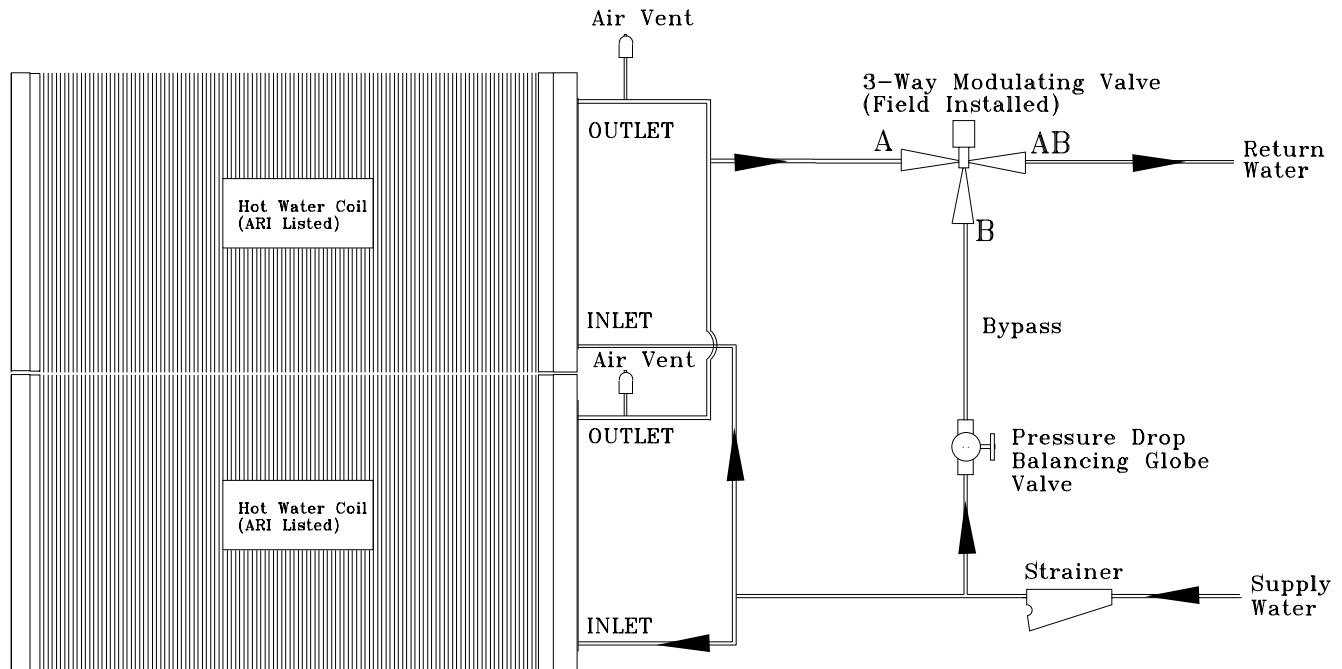
Utilizes two steam coils stacked together. These two coils must be piped in a parallel arrangement. The steps listed below should be used in addition to the previous steps. Figure 3-13 illustrates the recommended piping configuration for the steam coils.

Figure 3-12

Hot Water Piping (20 through 75 Ton)



Hot Water Piping (90 through 130 Ton)

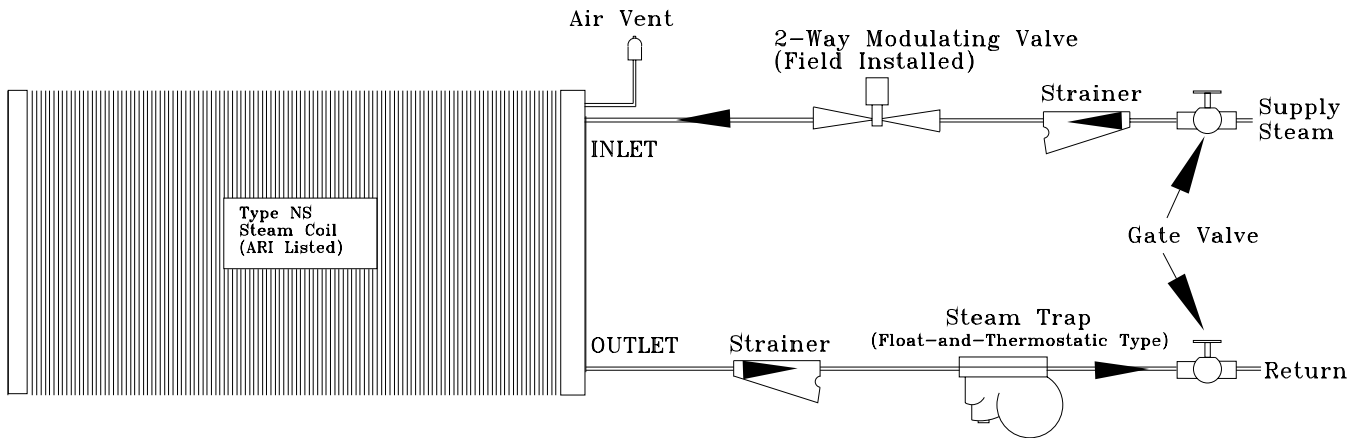


13. Install a strainer in each return line before the steam trap.

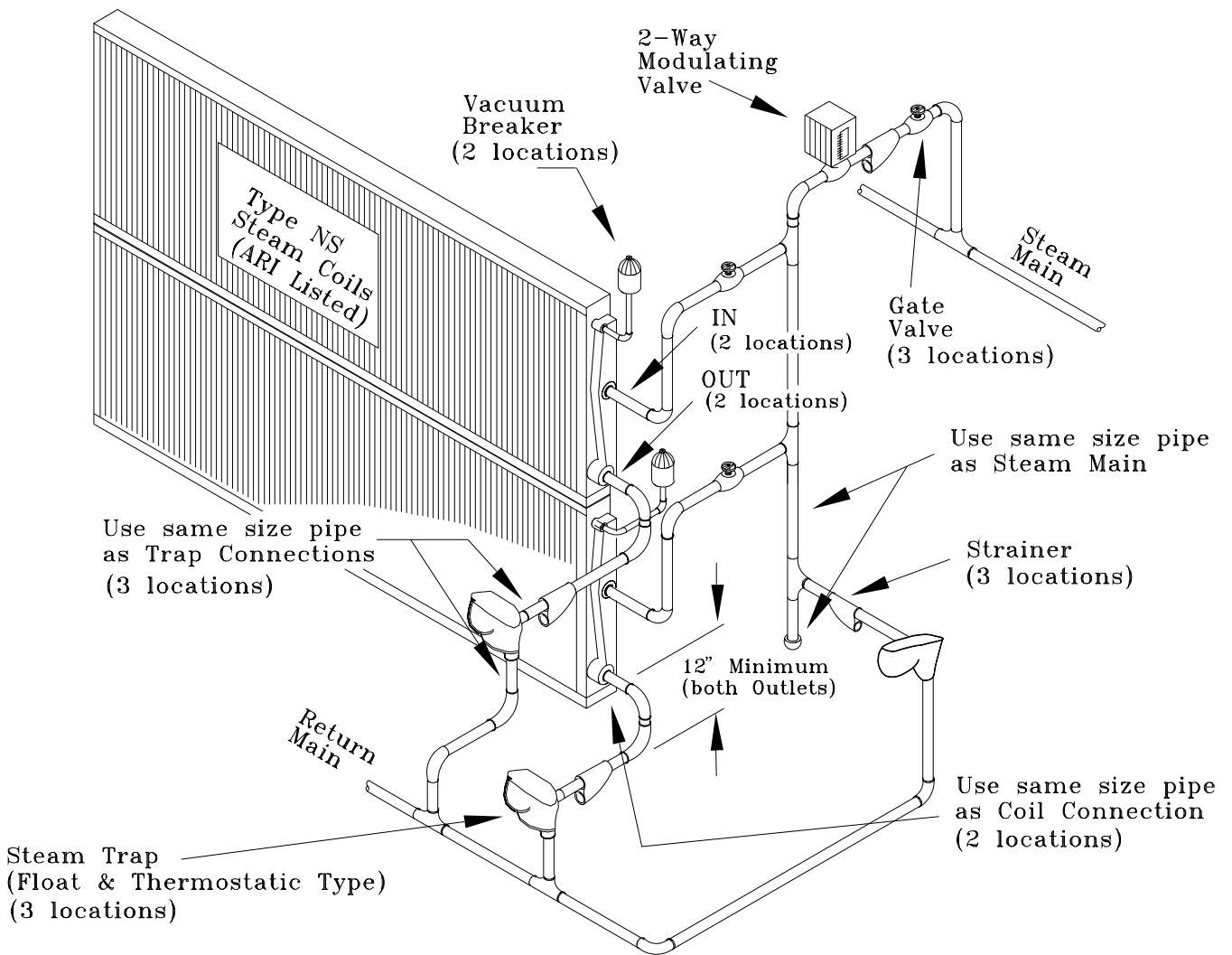
14. Trap each steam coil separately as described in steps 10 and 11 to prevent condensate backup in one or both coils.

15. In order to prevent condensate backup in the piping header supplying both coil sections, a drain must be installed utilizing a strainer and a steam trap as illustrated in Figure 3-13.

Figure 3-13
Steam Coil Piping (20 through 30 Ton Units)



Steam Coil Piping (40 through 130 Ton Units)



Disconnect Switch External Handle (Factory Mounted Option)

Units ordered with the factory mounted disconnect switch comes equipped with an externally mounted handle. This allows the operator to disconnect power from the unit without having to open the control panel door. The handle locations and its three positions are shown below;

"ON" - Indicates that the disconnect switch is closed, allowing the main power supply to be applied at the unit.

"OFF" - Indicates that the disconnect switch is open, interrupting the main power supply to the unit controls.

"OPEN COVER/RESET" - Turning the handle to this position releases the handle from the disconnect switch, allowing the control panel door to be opened.

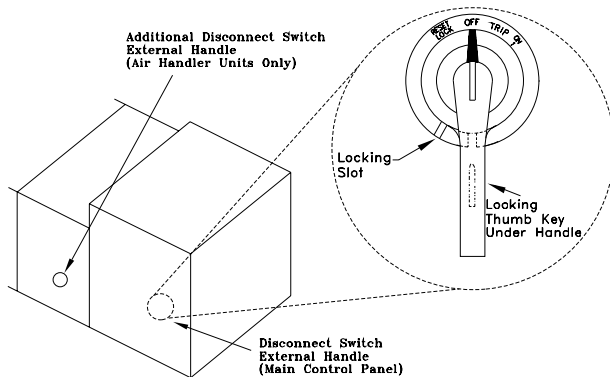
WARNING **Hazardous Voltage!**

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Once the door has been opened, it can be closed with the handle in any one of the three positions outlined above, provided it matches the disconnect switch position.

The handle can be locked in the "OFF" position. While holding the handle in the "OFF" position, push the spring loaded thumb key, attached to the handle, into the base slot. Place the lock shackle between the handle and the thumb key. This will prevent it from springing out of position.

An overall layout of the field required power wiring is illustrated in Figure 3-14. To insure that the unit's supply power wiring is properly sized and installed, follow the guidelines outlined below.



Note: All field installed wiring must conform to NEC guidelines as well as State and Local codes.

WARNING **Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in

Installation (Continued)

handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

Verify that the power supply available is compatible with the unit's nameplate rating for all components. The available power supply must be within 10% of the rated voltage stamped on the nameplate. Use only copper conductors to connect the 3-phase power supply to the unit.

CAUTION

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors may result in equipment damage.

Electric Heat Units (SEH_)

SEHF (20 through 75 Ton) electric heat units operating on 200/230 volts require two power supplies as illustrated in Figure 3-14. Unless the unit was ordered with the optional factory mounted non-fused disconnect switches, two field-supplied disconnect switches must be installed. The power wires for the electric heat is routed into the electric heat control panel using the thru-the-base access provided in the heating section. Refer to the appropriate illustration in Figure 3-2, (Unit Base layout and Electrical Entrance diagram), for dimensional data.

20 through 75 Ton units operating on 460/575 volts and all 90 through 130 Ton units require one power entry as illustrated in Figure 3-14.

Use the information provided in Table 3-7 and the "Power Wire Sizing & Protection Device Equations", to determine the appropriate wire size and Maximum Over current Protection for the heaters/unit.

Note: Each power supply must be protected from short circuit and ground fault conditions. To comply with NEC, protection devices must be sized according to the "Maximum Over current Protection" (MOP) or "Recommended Dual Element" (RDE) fuse size data on the unit nameplate.

Provide grounding for the supply power circuit in the electric heat control box.

Main Unit Power Wiring

Table 3-6 list the field connection wire ranges for both the main power terminal block 1TB1 and the optional main power disconnect switch 1S14. Table 3-7 list the component electrical data for 20 through 130 Ton units. The electrical service must be protected from over current and short circuit conditions in accordance with NEC requirements. Protection devices must be sized according to the electrical data on the nameplate. Refer to the "Power Wire Sizing & Protection Device Equations", for determining;

- the appropriate electrical service wire size based on "Minimum Circuit Ampacity" (MCA),
- the "Maximum Over current Protection" (MOP) device,
- the "Recommended Dual Element fuse size" (RDE).

Installation (Continued)

2. If the unit is not equipped with an optional factory-installed non-fused disconnect switch, a field supplied disconnect switch must be installed at or near the unit in accordance with the National Electrical Code (NEC latest edition). Refer to the "Power Wire Sizing & Protection Device Equations" (DSS calculation), for determining the correct size.

3. Location for the electrical service entrance is illustrated in Figure 3-2. Complete the unit's power wiring connections onto either the main terminal block 1TB1, or the factory mounted non-fused disconnect switch 1S14, inside the unit control panel. Refer to the customer connection diagram that shipped with the unit for specific termination points.

4. Provide proper grounding for the unit in accordance with local and national codes.

Figure 3-14
Typical Field Power Wiring (20 thru 75 Ton)

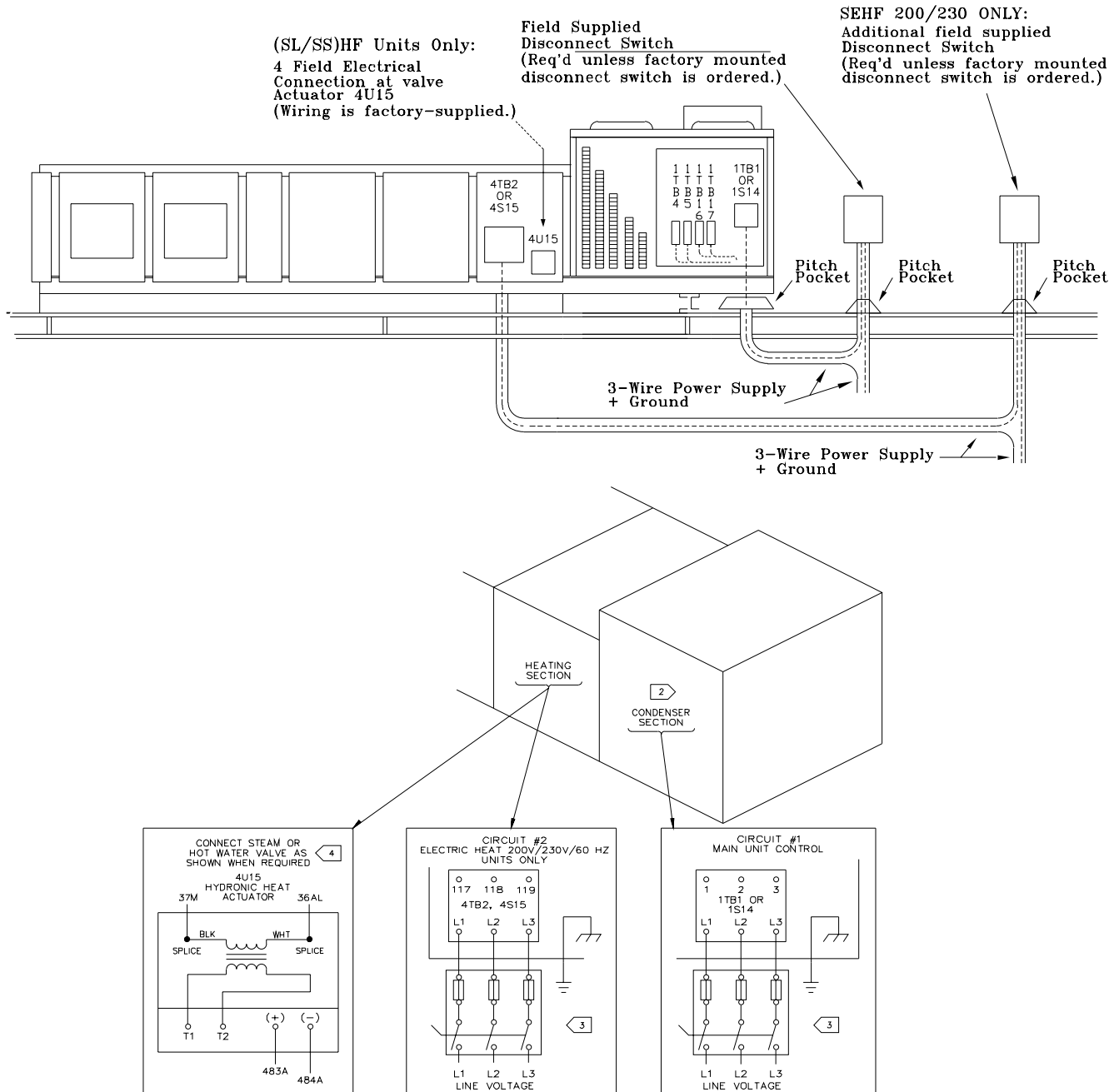


Figure 3-14 (Continued)
Typical Field Power Wiring (90 thru 130 Ton)

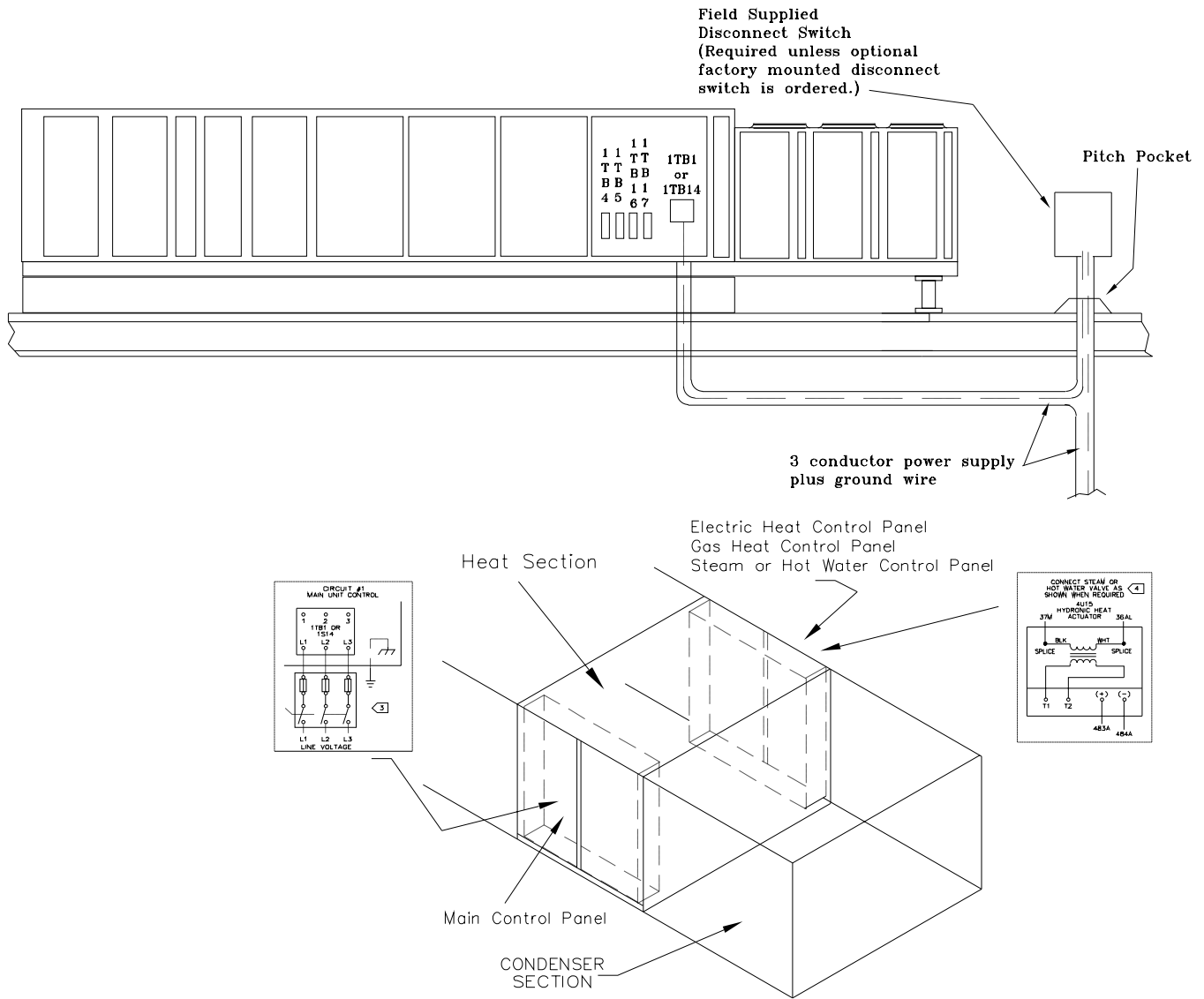


Table 3-6
Customer Connection Wire Range

CUSTOMER CONNECTION WIRE RANGE			
NOTES A. BLOCK SIZE DISCONNECT SIZE ARE CALCULATED BY SELECTING THE SIZE GREATER THAN OR EQUAL TO 115 X (SUM OF UNIT LOADS). SEE UNIT LITERATURE FOR UNIT LOAD VALUES.	UNITS WITH MAIN POWER TERMINAL BLOCK (ALL VOLTAGES)		
	BLOCK SIZE	WIRE QTY.	CONNECTOR WIRE RANGE
	335 AMP	(1)	#6 - 350 MCM
	760 AMP	(2)	#4 - 500 MCM
	840 AMP	(2)	#2 - 600 MCM
	UNITS WITH MAIN POWER DISCONNECT SWITCH (ALL VOLTAGES)		
	DISCONNECT SIZE	WIRE QTY.	CONNECTOR WIRE RANGE
	100 AMP	(1)	#14 - 1/0
	250 AMP	(1)	#4 - 350 kcmil
	400 AMP	(1) OR	#1 - 600 kcmil OR
	600 AMP	(2)	#1 - 250 kcmil
	1000 AMP	(3)	250-500 MCM 3/0 - 500 kcmil

NOTES:

1. ALL WIRING AND COMPONENTS SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL ELECTRICAL CODES.
2. CUSTOMER CONNECTIONS - MAIN UNIT CONTROL (CIRCUIT #1) - ARE LOCATED IN THE CONDENSER SECTION FOR 20 THRU 75 TON UNITS. CUSTOMER CONNECTIONS FOR 90 THRU 130 TON UNITS ARE LOCATED IN THE HEATING SECTION.
3. SEE CUSTOMER CONNECTION WIRE RANGE TABLE FOR ACCEPTABLE WIRE SIZES FOR CONNECTION TO MAIN UNIT TERMINAL BLOCK (1TB1/4TB2) OR DISCONNECT SWITCH (1S14/4S15).
4. WIRES TO THE OPTIONAL STEAM AND/OR HOT WATER HEAT VALVE ARE SUPPLIED WITH THE UNIT. WIRE CONNECTIONS TO THE VALVE TO BE MADE BY THE CUSTOMER.

Table 3-7
Electrical Service Sizing Data (20 through 130 Ton)

Unit Component(s)	200/60/3, Nominal (180-220V Utiliz.)		230/60/3, Nominal (207-253V Utiliz.)		460/60/3, Nominal (414-506V Utiliz.)		575/60/3, Nominal (517-633V Utiliz.)		
	RLA (ea)	LRA (ea)	RLA(ea)	LRA (ea)	RLA (ea)	LRA (ea)	RLA (ea)	LRA (ea)	
Compressor:									
20	A & B	41.9	269	41.9	251	18.2	117	14.6	94
25	B	62.8	409	62.8	376	27.3	178	21.8	143
	A	41.9	269	41.9	251	18.2	117	14.6	94
30	A & B	62.8	409	62.8	376	27.3	178	21.8	143
40	1,2A, 1,2B	41.9	269	41.9	251	18.2	117	14.6	94
50	1B & 2B	62.8	409	62.8	376	27.3	178	21.8	143
	1A & 2A	41.9	269	41.9	251	18.2	117	14.6	94
55	1,2A, 1,2B	62.8	409	62.8	376	27.3	178	21.8	143
60	1,2A, 1,2B	62.8	409	62.8	376	27.3	178	21.8	143
70	1,2A, 1,2B	41.9	269	41.9	251	18.2	117	14.6	94
	1,2C	62.8	409	62.8	376	27.3	178	21.8	143
75	1,2A, 1,2B	41.9	269	41.9	251	18.2	117	14.6	94
	1,2C	62.8	409	62.8	376	27.3	178	21.8	143
75	Hi-Cap 1,2A, 1,2B	41.9	269	41.9	251	18.2	117	14.6	94
	1,2C	62.8	409	62.8	376	27.3	178	21.8	143
90	1,2A	41.9	269	41.9	251	18.2	117	14.6	94
	1,2B & 1,2C	62.8	409	62.8	376	27.3	178	21.8	143
105	1,2A	62.8	409	62.8	376	27.3	178	21.8	143
	1,2B								
	1,2C								
115	1,2A & 1,2B	62.8	409	62.8	376	27.3	178	21.8	143
	1,2C & 1,2D	41.9	269	41.9	251	18.2	117	14.6	94
130	1,2A,B,C,D	62.8	409	62.8	376	27.3	178	21.8	143
Condenser Fans:		Total FLA (1)		Total FLA (1)		Total FLA (1)		Total FLA (1)	
20 Ton - 2 fans		8.2		8.2		3.6		2.8	
25/30 Ton - 3 fans		12.3		12.3		5.4		4.2	
40 Ton - 4 fans		16.4		16.4		7.2		5.6	
50 - 75 Ton, 6 fans		24.6		24.6		10.8		8.4	
90 Ton, 8 fans		32.8		32.8		14.4		11.2	
105 & 115 Ton, 10 fans		41		41		24		14	
130 Ton, 12 fans		49.2		49.2		28.8		16.8	
Supply Fan Motor		FLA (ea.)		FLA (ea.)		FLA (ea.)		FLA (ea.)	
Horsepower:									
3.0 HP		10.4		9		4.5		3.8	
5.0 HP		16		14.2		7.1		5.8	
7.5 HP		24.8		21.6		10.8		8.6	
10.0 HP		30.6		26.6		13.3		10.6	
15.0 HP (2)		44.9		40		20		15.6	
20.0 HP (2)		57.5		51		25.5		20.5	
25.0 HP (2)		75		65		32.5		26	
30.0 HP (2)		81		74		37		31	
40.0 HP (2)		121		105.8		52.9		42.4	
Exhaust Fan Motor		FLA		FLA		FLA		FLA	
Horsepower:									
1.5 HP		5.5		4.8		2.4		1.9	
3.0 HP		10.4		9		4.5		3.8	
5.0 HP		16		14.2		7.1		5.8	
7.5 HP		24.8		21.6		10.8		8.6	
10.0 HP		30.6		26.6		13.3		10.6	
15.0 HP		44.9		40		20		15.6	
20.0 HP		57.5		51		25.5		20.5	
25-HP		75		65		32.5		26	
30-HP		81		74		37		31	
40-HP		121		105.8		52.9		42.4	

Notes:

1. "Full load amp" values represents the total condenser fan amps.
2. Two (2) motors are used on 90 through 130 Ton units.

Table 3-7 (Continued)**Electrical Service Sizing Data (20 through 130 Ton)**

Unit Component(s)	200/60/3, Nominal (180-220V Utiliz.)	230/60/3, Nominal (207-253V Utiliz.)	460/60/3, Nominal (414-506V Utiliz.)	575/60/3, Nominal (517-633V Utiliz.)
Electric Heat (SEHF Only):	FLA (3)	FLA (3)	FLA (3)	FLA (3)
30 Kw	83.3	72.2	36.1	28.9
50 Kw	138.8	120.3	60.1	48.1
70 Kw	194.3	168.4	84.2	67.4
90 Kw	249.8	216.5	108.3	86.6
110 Kw	305.3	264.6	132.3	105.9
130 Kw	-n/a-	-n/a-	156.4	125.1
150 Kw	-n/a-	-n/a-	180.4	144.3
170 Kw	-n/a-	-n/a-	204.5	163.6
190 Kw	-n/a-	-n/a-	228.5	182.8
Combustion Blower Motor (SFHF Only):	FLA	FLA	FLA	FLA
235, 350, 500 MB	2.1	1.8	0.9	0.7
850 & 1,000 MBh	2.8	2.4	1.2	1

Unit Tonnage	No. of Compressors	Tonnage	Type	Designation
20 Ton Std and Hi-Capacity	Two	9 - Ton	Scrolls	A & B
25 Ton Std and Hi-Capacity	One	14 - Ton	Scroll	B
	One	9 - Ton	Scroll	A
30 Ton Std and Hi-Capacity	Two	14 - Ton	Scrolls	A & B
40 Ton Std and Hi-Capacity	Four	9 - Ton	Scrolls	1A, 1B, 2A, 2B
50 Ton Std and Hi-Capacity	Two	14 - Ton	Scrolls	1B & 2B
	Two	9 - Ton	Scrolls	1A & 2A
55 Ton Std and Hi-Capacity	Four	14 - Ton	Scrolls	1A, 1B, 2A, 2B
60Ton Std and Hi-Capacity	Four	14 - Ton	Scrolls	1A, 1B, 2A, 2B
70 / 75 Ton Std	Four	9 - Ton	Scrolls	1A, 1B, 2A, 2B
	Two	14 - Ton	Scrolls	1 C & 2C
75 Ton Hi-Capacity	Four	10 - Ton	Scrolls	1A & 2A, 1B & 2B
	Two	15- Ton	Scrolls	1C, 2C
90 Ton	Two	10 - Ton	Scrolls	1A & 2A
	Four	15 - Ton	Scrolls	1, 2B & 1,2C
105 Ton	Six	15 - Ton	Scrolls	1,2A, 1,2B, 1,2C
115 Ton	Four	15 - Ton	Scrolls	1,2A & 1,2B
	Four	10 - Ton	Scrolls	1,2C & 1,2D
130 Ton	Eight	14 - Ton	Scrolls	1,2A, 1,2B, 1,2C, 1,2D

Note:

3. "Full load amp" values shown for the electric heat were determined at 480 and 600 volts, respectively.

Figure 3-15 Power Wire Sizing and Protection Device Equations

To correctly size the main power wiring for the unit, use the appropriate calculation(s) listed below. Read the load definitions that follow and use Calculation #1 for determining the MCA (Minimum Circuit Ampacity), MOP (Maximum Over current Protection), and RDE (Recommended Dual Element fuse size) for SAH_ (Cooling Only) units, SXH_ (Extended Casing) units, SLH_ and SSH_ (Cooling with Wet Heat) units, and SFH_ (Cooling with Gas Heat) units Use Calculation #2 for SEH_ (Cooling with electric Heat) units.

- Load Definitions:**
- LOAD 1** = CURRENT OF THE LARGEST MOTOR (COMPRESSOR OR FAN MOTOR)
 - LOAD 2** = SUM OF THE CURRENTS OF ALL REMAINING MOTORS
 - LOAD 3** = CURRENT OF ELECTRIC HEATERS
 - LOAD 4** = ANY OTHER LOAD RATED AT 1 AMP OR MORE
- CONTROL POWER TRANSFORMER FOR ALL MODES
- 20 - 40 Ton Units, add 3 FL Amps
 - 50 - 75 Ton Units, add 6 FL Amps
 - 90 - 130 Ton Units, Add 8 FL Amps
- CRANKCASE HEATERS FOR HEATING MODE 460/575V ONLY
- 20 - 30 Ton Units, Add 1 Amp
 - 40 - 60 Ton Units, Add 2 Amps
 - 70 - 105 Ton Units, Add 3 Amps
 - 115 - 130 Ton Units, Add 4 Amps

Calculation #1 - SAH_, SXH_, SLH_, SSH_, and SFH_ Units.

$$\text{MCA} = (1.25 \times \text{LOAD 1}) + \text{LOAD 2} + \text{LOAD 4}$$

$$\text{MOP} = (2.25 \times \text{LOAD 1}) + \text{LOAD 2} + \text{LOAD 4}$$

Select a fuse rating equal to the MOP value. If the MOP value does not equal a standard fuse size as listed in NEC 240 - 6, select the next lower standard fuse rating.

Note: If selected MOP is less than the MCA, then select the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the selected fuse size does not exceed 800 amps.

$$\text{RDE} = (1.5 \times \text{LOAD1}) + \text{LOAD2} + \text{LOAD4}$$

Select a fuse rating equal to the RDE value. If the RDE value does not equal a standard fuse size as listed in NEC 240 - 6, select the next higher standard fuse rating.

Note: If the selected RDE is greater than the selected MOP value, then select the RDE value to equal the MOP value.

Calculation #2 - Rooftop units with Electric Heat (SEH_ 20 - 130 Tons)

A. Single Source Power (380V, 415V, 460V, and 575V)

To arrive at the correct MCA, MOP, and RDE values for these units, you must perform two sets of calculations. First calculate the MCA, MOP, and RDE values as if the unit was operating in the cooling mode (use the equations given in Calculation #1 above). Then calculate the MCA, MOP, and RDE values as if the unit was operating in the heating mode as follows. (Keep in mind when determining LOADS that the compressors do not operate while the unit is in the heating mode).

For units using heaters less than 50 kw: $\text{MCA} = 1.25 \times (\text{LOAD 1} + \text{LOAD 2} + \text{LOAD 4}) + (1.25 \times \text{LOAD 3})$

For units using heaters equal to or greater than 50 kw: $\text{MCA} = 1.25 \times (\text{LOAD 1} + \text{LOAD 2} + \text{LOAD 4}) + \text{LOAD 3}$

The nameplate MCA value will be the larger of the cooling mode MCA value or the heating mode MCA value calculated above.

$$\text{MOP} = (2.25 \times \text{LOAD 1}) + \text{LOAD 2} + \text{LOAD 3} + \text{LOAD 4}$$

The selected MOP value will be the larger of the cooling mode MOP value or the heating mode MOP value calculated above.

Select a fuse rating equal to the MOP value. If the MOP value does not equal a standard fuse size as listed in NEC 240 - 6, select the next lower standard fuse rating.

Note: If selected MOP is less than the MCA, then select the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the selected fuse size does not exceed 800 amps.

Continued on the Next Page

Power Wire Sizing and Protection Device Equations (Continued)

$$\text{RDE} = (1.5 \times \text{LOAD 1}) + \text{LOAD 2} + \text{LOAD 3} + \text{LOAD 4}$$

The selected RDE value will be the larger of the cooling mode RDE value or the heating mode RDE value calculated above.

Select a fuse rating equal to the RDE value. If the RDE value does not equal a standard fuse size as listed in NEC 240 - 6, select the next higher standard fuse rating.

Note: If the selected RDE is greater than the selected MOP value, then select the RDE value to equal the MOP value.

B. Dual Source Power units (200V and 230V)

These units will have two circuit values shown on the nameplate. The first circuit value will be the refrigeration (cooling mode) values calculated using calculation #1 above. The second set of circuit values shown on the nameplate will be for the electric heating circuit as follows.

$$\text{MCA} = (1.25 \times \text{LOAD 3})$$

$$\text{MOP} = (1.25 \times \text{LOAD 3})$$

Select a fuse rating for the electric heating circuit that's equal to the MOP value obtained in the equation above. If the MOP value does not equal a standard fuse size as listed in NEC 240 - 6, select the next lower standard fuse rating (see note below for exception).

Note: If selected MOP is less than the MCA obtained in the equation above, then select the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the selected fuse size does not exceed 800 amps.

$$\text{RDE} = \text{LOAD 3}$$

Select a fuse rating for the electric heating circuit that's equal to the RDE value. If the RDE value does not equal a standard fuse size as listed in NEC 240 - 6, select the next higher standard fuse rating.

Note: If the selected RDE is greater than the selected MOP value, then select the RDE value to equal the MOP value.

Disconnect Switch Sizing (DSS)

Calculation #1 - SX, SF, SA, SL, or SS Single Power Source Units

$$\text{DSS} = 1.15 \times (\text{LOAD 1} + \text{LOAD 2} + \text{LOAD 4})$$

Calculation #2 - All SEH_ Single Power Source Units

$$\text{DSS} = 1.15 \times (\text{LOAD 3} + \text{Supply Fan FLA} + \text{Exhaust Fan FLA})$$

PLUS

$$\text{DSS} = 1.15 \times (\text{LOAD 1} + \text{LOAD 2} + \text{LOAD 4})$$

Use the larger value of the two calculations to size the electrical service.

Calculation #3 - SEHF (200/230 Volt) 20 - 75 Ton Dual Power Source Units

$$\text{DSS} = 1.15 \times \text{LOAD3 for the Electric heater AND Calculation \#1 for the Refrigeration Components}$$

Field Installed Control Wiring

The Rooftop Module (RTM) must have a mode input in order to operate the rooftop unit. The flexibility of having several system modes depends upon the type of sensor and/or remote panel selected to interface with the RTM. An overall layout of the various control options available for a Constant Volume application, with the required number of conductors for each device, is illustrated in Figure 3-16. Figure 3-17 illustrates the various control options with the required number of conductors for a Variable Air Volume application.

Note: All field wiring must conform to NEC guidelines as well as state and local codes.

The various field installed control panels, sensors, switches, and contacts discussed in this section require both AC and DC consideration. These diagrams are representative of standard applications and are provided for general reference only. Always refer to the wiring diagram that shipped with the unit for specific electrical schematic and connection information.

WARNING **Hazardous Voltage!**

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Controls using 24 VAC

Before installing any connecting wiring, refer to Figure 3-2 for the electrical access locations provided on the unit and Table 3-8 for AC conductor sizing guidelines, and;

- Use copper conductors unless otherwise specified.
- Ensure that the AC control wiring between the controls and the unit's termination point does not exceed three (3) ohms/conductor for the length of the run.

Note: Resistance in excess of 3 ohms per conductor may cause component failure due to insufficient AC voltage supply.

- Be sure to check all loads and conductors for grounds, shorts, and miswiring.

Table 3-8
AC Conductors

Distance from Unit to Control	Recommended Wire Size
000 - 460 feet	18 gauge
461 - 732 feet	16 gauge
733 - 1000 feet	14 gauge

- Do not run the AC low voltage wiring in the same conduit with the high voltage power wiring.

Installation (Continued)

Controls using DC Analog Input/Outputs

Before installing any connecting wiring between the unit and components utilizing a DC analog input/output signal, refer to the appropriate illustration in Figure 3-2 for the electrical access locations provided on the unit and Table 3-9 for conductor sizing guidelines and;

- Use standard copper conductor thermostat wire unless otherwise specified.
- Ensure that the wiring between the controls and the unit's termination point does not exceed two and a half (2.5) ohms/conductor for the length of the run.

Note: Resistance in excess of 2.5 ohms per conductor can cause deviations in the accuracy of the controls.

Table 3-9
DC Conductors

Distance from Unit to Control	Recommended Wire Size
000 - 150 feet	22 gauge
151 - 240 feet	20 gauge
241 - 385 feet	18 gauge
386 - 610 feet	16 gauge
611 - 970 feet	14 gauge

- Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires.

Units equipped with a Trane Communication Interface (TCI) or LonTalk Communication Interface (LCI) option which utilizes a serial communication link;

- Must be 18 AWG shielded twisted pair cable (Belden 8760 or equivalent).
- Must not exceed 5,000 feet maximum for each link.
- Must not pass between buildings.

Constant Volume System Controls

Remote Panel w/o NSB (5U56) - BAYSENS010B

This electronic sensor features four system switch settings (Heat, Cool, Auto, and Off) and two fan settings (On and Auto) with four system status LED's. It is a manual or automatic changeover control with dual setpoint capability. It can be used with a remote zone sensor BAYSENS017B. Refer to Table 3-10 for the Temperature vs Resistance coefficient.

Remote Panel w/ NSB (5U58) - BAYSENS019*

This 7 day programmable sensor features four periods for Occupied/Unoccupied programming per day. If the power is interrupted, the program is retained in permanent memory. If power is off longer than 2 hours, only the clock and day may have to be reset.

The six programming keys located on the front panel allows selection of four system modes (Heat, Cool, Auto, and Off), two fan modes (On and Auto). It has dual temperature selection with programmable start time capability.

The occupied cooling setpoint ranges between 40 and 80 Fahrenheit. The warm-up setpoint ranges between 50 and 90 degrees Fahrenheit with a 2 degrees deadband. The Unoccupied cooling setpoint ranges between 45 and 98 degrees Fahrenheit. The heating setpoint ranges between 43 and 96 degrees Fahrenheit.

Two liquid crystal displays (LCD) display zone temperature, temperature setpoints, week day, time, and operational mode symbols.

The DIP switches on the subbase are used to enable or disable applicable functions, i.e.; Morning Warm-up, Economizer minimum CFM override during unoccupied status, Fahrenheit or Centigrade, Supply air tempering, Remote zone temperature sensor, 12/24 hour time display, Smart fan, and Computed recovery.

During an occupied period, an auxiliary relay rated for 1.25 amps @ 30 volts AC with one set of single pole double throw contacts is activated. See Table 3-10 for the Temperature vs Resistance coefficient.

Constant Volume Zone Panel (5U68) - BAYSENS008B

This electronic sensor features four system switch settings (Heat, Cool, Auto, and Off) and two fan settings (On and Auto). It is a manual or automatic changeover control with dual setpoint capability.

Variable Air Volume System Controls

Remote Panel w/ NSB (5U58) - BAYSENS020B

This 7 day programmable sensor features four periods for Occupied/Unoccupied programming per day. Either one or all four periods can be programmed. If the power is interrupted, the program is retained in permanent memory. If power is off longer than 2 hours, only the clock and day may have to be reset.

The front panel allows selection of Occupied/Unoccupied periods with two temperature inputs (Cooling Supply Air Temperature and Heating Warm-up temperature) per occupied period. The occupied cooling setpoint ranges between 40 and 80 Fahrenheit. The warm-up setpoint ranges between 50 and 90 degrees Fahrenheit with a 2 degrees deadband. The Unoccupied cooling setpoint ranges between 45 and 98 degrees Fahrenheit. The heating setpoint ranges between 43 and 96 degrees Fahrenheit.

The liquid crystal display (LCD) displays zone temperature, temperature setpoints, week day, time, and operational mode symbols.

The DIP switches on the subbase are used to enable or disable applicable functions, i.e.; Morning warm-up, economizer minimum position override during unoccupied status, heat installed, remote zone temperature sensor, 12/24 hour time display, and daytime warm-up. Refer to Table 3-10 for the Temperature vs Resistance coefficient.

During an occupied period, an auxiliary relay rated for 1.25 amps @ 30 volts AC with one set of single pole double throw contacts is activated.

Remote Panel w/o NSB (5U59) - BAYSENS021A

The remote panel w/o Night setback has a system switch as well as a S/A temperature setpoint indicator, a local sensor, and four LED's. These features allow the operator to control

Installation (Continued)

system operation, and monitor unit operating status from a remote location. Use the installation instructions that shipped with the panel to install it, and the unit's field wiring diagram to connect it to the unit.

VAV Changeover Contacts (5K87)

These contacts are connected to the RTM when daytime heating on VAV units with internal or external hydronic heat is required. Daytime (occupied) heating switches the system to a CV type mode of operation. Refer to the unit wiring diagram for the field connection terminals in the unit control panel. The switch must be rated at 12 ma @ 24 VDC minimum.

Constant Volume or Variable Air Volume System Controls

Remote Human Interface Module (5U66)

The remote Human Interface module enables the operator to set of modify the operating parameters of the unit using it's 16 key keypad and view the operating status of the unit on the 2 line, 40 character LCD screen without leaving the building. However, the Remote Human Interface module can not be used to perform any service functions.

One remote panel is designed to monitor and control up to four units providing each of the units are equipped with an IPCB module. Use the installation instructions that shipped with the module to install it, and the appropriate illustrations in Figure 3-16 or 3-17 to connect it to the unit.

Remote Zone Sensor (BAYSENS013C)

This electronic analog sensor features remote zone sensing and timed override with override cancellation. It is used when the RTM has been programmed as the source for zone temperature control. Refer to Table 3-10 for the Temperature vs Resistance coefficient.

Remote Zone Sensor (BAYSENS014C)

This electronic analog sensor features single setpoint capability and timed override with override cancellation. It is used with a Trane Integrated Comfort™ system. Refer to Table 3-10 for the Temperature vs Resistance coefficient.

Remote Zone Sensor (5RT16, 5U57, and 5U69) (BAYSENS016A)

This bullet type analog Temperature sensor can be used for; outside air (ambient) sensing, return air temperature sensing, supply air temperature sensing, remote temperature sensing (uncovered), morning warm-up temperature sensing, and for VAV zone reset. Wiring procedures vary according to the particular application and equipment involved. When this sensor is wired to a BAYSENS019* or BAYSENS020* Remote Panel, wiring must be 18 AWG Shielded Twisted Pair (Belden 8760 or equivalent). Refer to Table 3-10 for the Temperature vs Resistance coefficient.

Remote Zone Sensor (5RT16, 5U57, and 5U69) (BAYSENS017B)

This electronic analog sensor can be used with BAYSENS019*, 020*, or 021A Remote Panels. When this sensor is wired to a BAYSENS019* or BAYSENS020* Remote Panel, wiring must be 18 AWG Shielded Twisted Pair (Belden 8760 or equivalent). Refer to the specific Remote Panel for wiring details.

Installation (Continued)

Remote Minimum Position Potentiometer (5U70) (BAYSTAT023A)

The remote minimum position potentiometer is used on units with an economizer. It allows the operator to remotely set the economizer's minimum position (which controls the amount of outside air entering the unit). Use the installation instructions that shipped with the potentiometer to install it, and the appropriate illustrations in Figure 3-16 or 3-17 to connect it to the unit.

External Auto/Stop Switch (5S67)

A field supplied single pole single throw switch (5S67) may be used to shut down the unit operation. This switch is a binary input wired to the RTM. When opened, the unit shuts down immediately and can be cancelled by closing the switch. Refer to the appropriate illustrations in Figure 3-16 or 3-17 for the proper connection terminals in the unit control panel. The switch must be rated for 12 ma @ 24 VDC minimum.

VOM Contacts (5K90, 5K91, 5K92, 5K93, 5K94)

If the unit is equipped with a Ventilation Override Module (VOM), (i.e. unit model number digit 21+ is a "N"), a number of special functions can be specified by the building owner or contractor. These functions can include, but are not limited to; (1) Unit Off, (2) Pressurization, (3) Exhaust, (4) Purge, and (5) Purge with Duct Pressure Control. They are controlled by binary inputs wired to the VOM. These functions can be initiated by; a toggle switch, a time clock, or an ICS™ output. The switch must be rated for 12 ma @ 24 VDC minimum. The following preset sequences can be modified by the customer;

1. VOM Mode "A" Priority 1 - Unit Off:

- Supply fan - OFF
- Inlet vanes/VFD - 0% (if equipped)
- Exhaust fan - OFF, Exhaust dampers Closed
- O/A dampers - Closed
- Heat - All stages OFF, Modulating Heat output at 0 vdc
- Occupied/Unoccupied output - De-energized (Occupied)
- VO Relay - Energized
- Pre-heater State - Off (if equipped)

2. VOM Mode "B" Priority 2 - Pressurize:

- Supply fan - ON
- Inlet Vanes/VFD - 100% (if equipped)
- Exhaust fan - OFF, Exhaust dampers - Closed
- O/A dampers - Open
- Heat - All stages OFF, Modulating Heat output at 0 vdc
- Occupied/Unoccupied output - Energized (Unoccupied)
- VO Relay - Energized
- Pre-heater State - Off (if equipped)

3. VOM Mode "C" Priority 3 - Exhaust:

- Supply fan - OFF
- Inlet Vanes/VFD - 0% (if equipped)
- Exhaust fan - ON, Exhaust dampers - Open
- O/A dampers - Closed
- Heat - All stages OFF, Modulating Heat output at 0 vdc
- Occupied/Unoccupied output - De-energized (Occupied)
- VO Relay - Energized
- Pre-heater State - Off (if equipped)

4. VOM Mode "D" Priority 4 - Purge:

- Supply fan - ON
- Inlet Vanes/VFD - 100% (if equipped)
- Exhaust fan - ON, Exhaust dampers - Open
- O/A dampers - Open
- Heat - All stages OFF, Modulating Heat output at 0 vdc
- Occupied/Unoccupied output - Energized (Unoccupied)
- VO Relay - Energized
- Pre-heater State - Off (if equipped)

5. VOM Mode "E" Priority 5 - Purge with duct pressure control:

- Supply fan - ON
- Inlet Vanes/VFD - (if equipped) Controlled by S/A Pressure Control with supply air pressure high limit disabled.
- Exhaust fan - ON, Exhaust dampers - Open
- O/A dampers - Open
- Heat - All stages OFF, Modulating Heat output at 0 vdc
- Occupied/Unoccupied output - Energized (Unoccupied)
- VO Relay - Energized
- Pre-heater State - Off (if equipped)

"OFF" - will appear in the Ventilation Override screen after all VOM binary inputs have been reset (opened).

Due to codes in some areas, the definitions for some or all of the VOM modes may have to be locked into the program by the user. Once the definitions are locked, the Ventilation Override Module must be replaced in order to reprogram that sequence.

Refer to Figure 3-16 & 3-17 for the proper connection terminals in the unit control panel for each of the VOM initiating device's and the appropriate Programming, Troubleshooting Guide (PTG Latest Edition) for programming instructions.

Emergency Override Definitions (with LCI-I module installed)

When an LCI-I module is installed, the user can initiate one of five (5) Emergency Override sequences that have the following predefined unit operation:

PRESSURIZE

- Supply Fan - On
- Inlet Vanes - Open (if equipped)
- Exhaust Fan - Off (if equipped)
- Exhaust Dampers - Closed (if equipped)
- OA Dampers - Open
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.
- Occupied/Unoccupied output - Energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)

DEPRESSURIZE

- Supply Fan - Off
- Inlet Vanes - Closed (if equipped)
- Exhaust Fan - On (if equipped)
- Exhaust Dampers - Open (if equipped)
- OA Dampers - Closed
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.
- Occupied/Unoccupied output - De-energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)

PURGE

- Supply Fan - On
- Inlet Vanes - Open (if equipped)
- Exhaust Fan - On (if equipped)
- Exhaust Dampers - Open (if equipped)
- OA Dampers - Open
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.
- Occupied/Unoccupied output - Energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)

SHUTDOWN

- Supply Fan - Off
- Inlet Vanes - Closed (if equipped)
- Exhaust Fan - Off (if equipped)
- Exhaust Dampers - Closed (if equipped)
- OA Dampers - Closed
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.
- Occupied/Unoccupied output - De-energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)

FIRE

- Supply Fan - Off
- Inlet Vanes - Closed (if equipped)
- Exhaust Fan - Off (if equipped)
- Exhaust Dampers - Closed (if equipped)
- OA Dampers - Closed
- Heat - All heat stages Off (staged gas and elec.), Hydronic heat & Mod Gas Heat output at 0%.
- Occupied/Unoccupied output - De-energized
- VO Relay - Energized (with VOM module installed)
- OA Preheater State - Off (with VCM module installed)

Table 3-10 - Temperature vs. Resistance Coefficient

The UCM network relies on various sensors located throughout the system to provide temperature information in the form of an analog input. All of the sensors used have the same temperature vs. resistance co-efficient and are made from Keystone Carbon D97 material with a 1 degree Centigrade tolerance.

Temperature (F)	Resistance (in. 1000 Ohms)	Temperature (F)	Resistance (in. 1000 Ohms)
-40	346.1	71	11.6
-30	241.7	72	11.31
-20	170.1	73	11.03
-10	121.4	74	10.76
-5	103	75	10.5
0	87.56	76	10.25
5	74.65	77	10
10	63.8	78	9.76
15	54.66	79	9.53
20	46.94	80	9.3
25	40.4	85	8.25
30	34.85	90	7.33
35	30.18	100	5.82
40	26.22	105	5.21
45	22.85	110	4.66
50	19.96	120	3.76
55	17.47	130	3.05
60	15.33	140	2.5
65	13.49	150	2.05
66	13.15	160	1.69
67	12.82	170	1.4
68	12.5	180	1.17
69	12.19	190	0.985
70	11.89	200	0.83

Emergency Stop Switch (5S71)

A normally closed (N.C.) switch (5S71) wired to the RTM may be used during emergency situations to shut down all unit operations. When opened, an immediate shutdown occurs. An emergency stop diagnostic is entered into the Human Interface and the unit must be manually reset. Refer to the appropriate illustrations in Figure 3-16 or 3-17 for the proper connection terminals in the unit control panel. The switch must be rated for 12 ma @ 24 VDC minimum.

Occupied/Unoccupied Contacts (5K86)

To provide Night Setback control if a remote panel with NSB (5U58) was not ordered, a field supplied contact (5K86) must be installed. This binary input provides the Occupied/Unoccupied status information of the building to the RTM. It can be initiated by a time clock, or a Building Automation System control output. The relay's contacts must be rated for 12 ma @ 24 VDC minimum. Refer to the appropriate illustrations in Figure 3-16 or 3-17 for the proper connection terminals in the unit control panel.

Demand Limit Relay (5K89)

If the unit is equipped with a Generic BAS Module (1U51), (i.e. unit model number digit 21+ is a "K"), a normally open (N.O.) switch may be used to limit the electrical power usage during peak periods. When demand limit is initiated, the mechanical cooling and heating operation is limited to either 50% or 100%. Demand limit can be initiated by a toggle switch closure, a time clock, or an ICS™ control output. These contacts must be rated for 12 ma @ 24 VDC minimum.

Outside Air Sensor (3RT3) - BAYSENS016A

This device senses the outdoor air temperature and sends this information in the form of an analog input to the RTM. It's factory installed on units with an economizer, but can be field provided/installed and used for informational purposes on units without an economizer. Refer to the appropriate illustrations in Figure 3-16 or 3-17 for the proper connection terminals in the unit control panel. Refer to Table 3-10 for Temperature vs Resistance coefficient.

Generic Building Automation System (1U51)

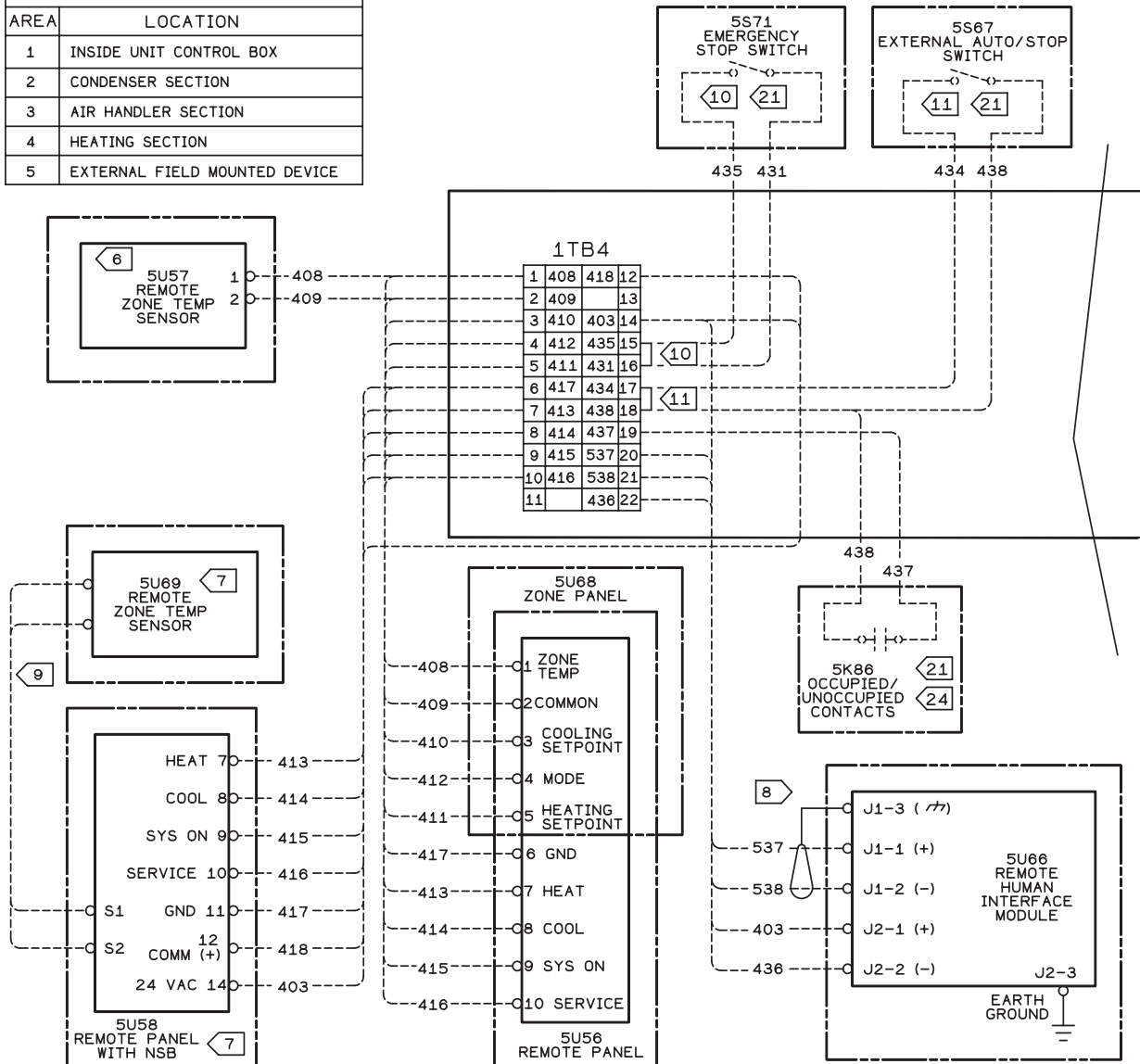
The Generic Building Automation System (GBAS) module allows a non-Trane building control system to communicate with the rooftop unit and accepts external setpoints in form of analog inputs for cooling, heating, demand limiting, and supply air pressure parameters. Refer to Figure 3-18 for the input wiring to the GBAS module and the various desired setpoints with the corresponding DC voltage inputs for both VAV and CV applications.

For complete application details of the module, refer to Engineering Bulletin UN-PRB001-EN.

Figure 3-16A
Typical Field Wiring Diagram for 20 through 130 Ton CV Control Options

<p style="text-align: center;">⚠ WARNING</p> <p>HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING. FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.</p>	<p style="text-align: center;">⚠ AVERTISSEMENT</p> <p>VOLTAGE HASARDEUX! DECONNECTEZ TOUTES LES SOURCES ELECTRIQUES INCLUANT LES DISJONCTEURS SITES A DISTANCE AVANT D'EFFECTUER L'ENTRETIEN. FAUTE DE DECONNECTER LA SOURCE ELECTRIQUE AVANT D'EFFECTUER L'ENTRETIEN PEUT ENTRAINER DES BLESSURES CORPORELLES SEVERES OU LA MORT.</p>	<p style="text-align: center;">⚠ CAUTION</p> <p>USE COPPER CONDUCTORS ONLY! UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS. FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.</p>
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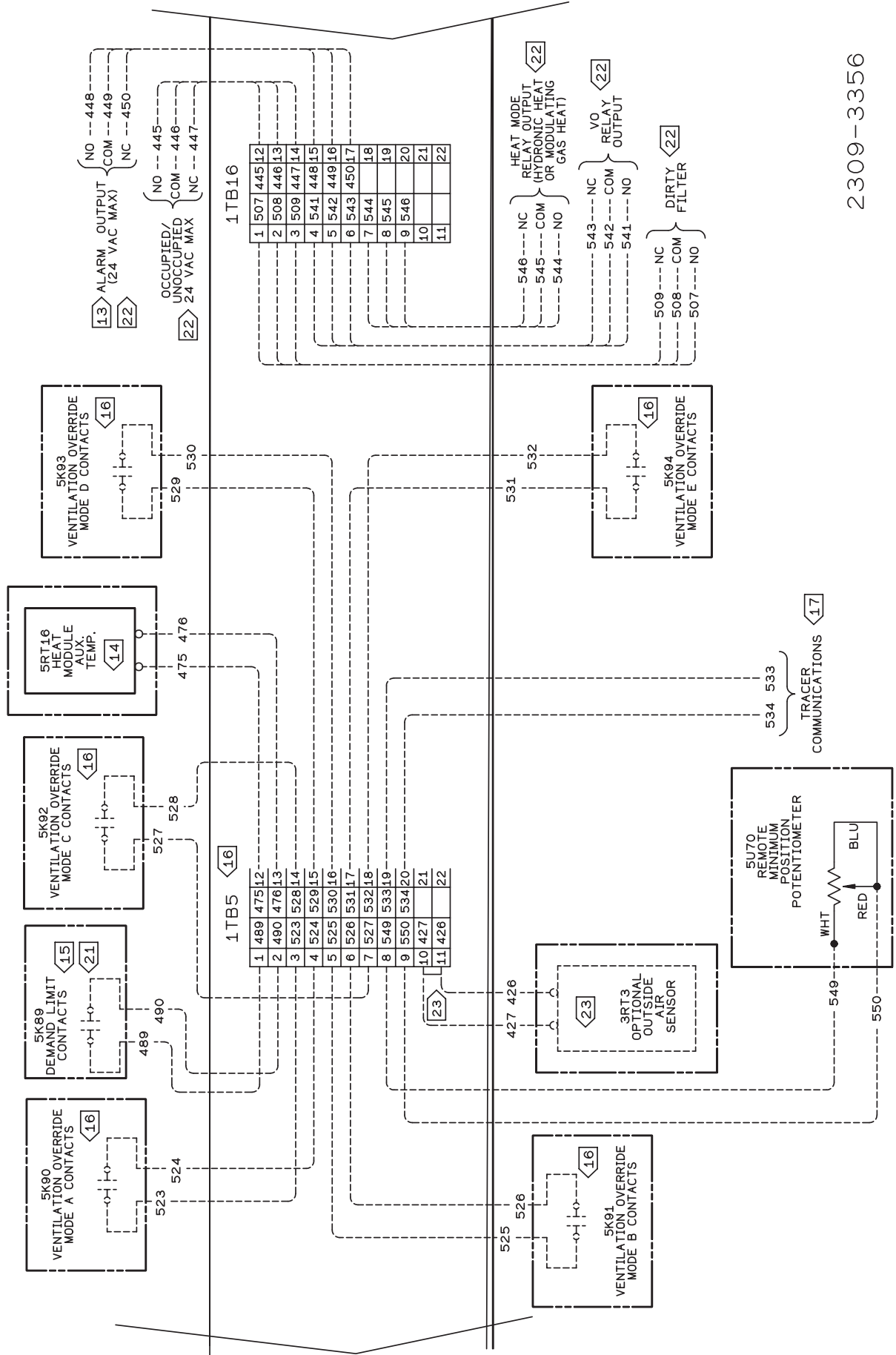
DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	INSIDE UNIT CONTROL BOX
2	CONDENSER SECTION
3	AIR HANDLER SECTION
4	HEATING SECTION
5	EXTERNAL FIELD MOUNTED DEVICE



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Refer to Wiring Notes on page 51

Figure 3-16B
 Typical Ventilation Override Binary Output Wiring Diagram for 20 through 130 Ton CV Control Options
 Refer to Wiring Notes on page 51



2309-3356

Field Connection Diagram Notes for 20 through 130 Ton CV or VAV Applications

NOTES:

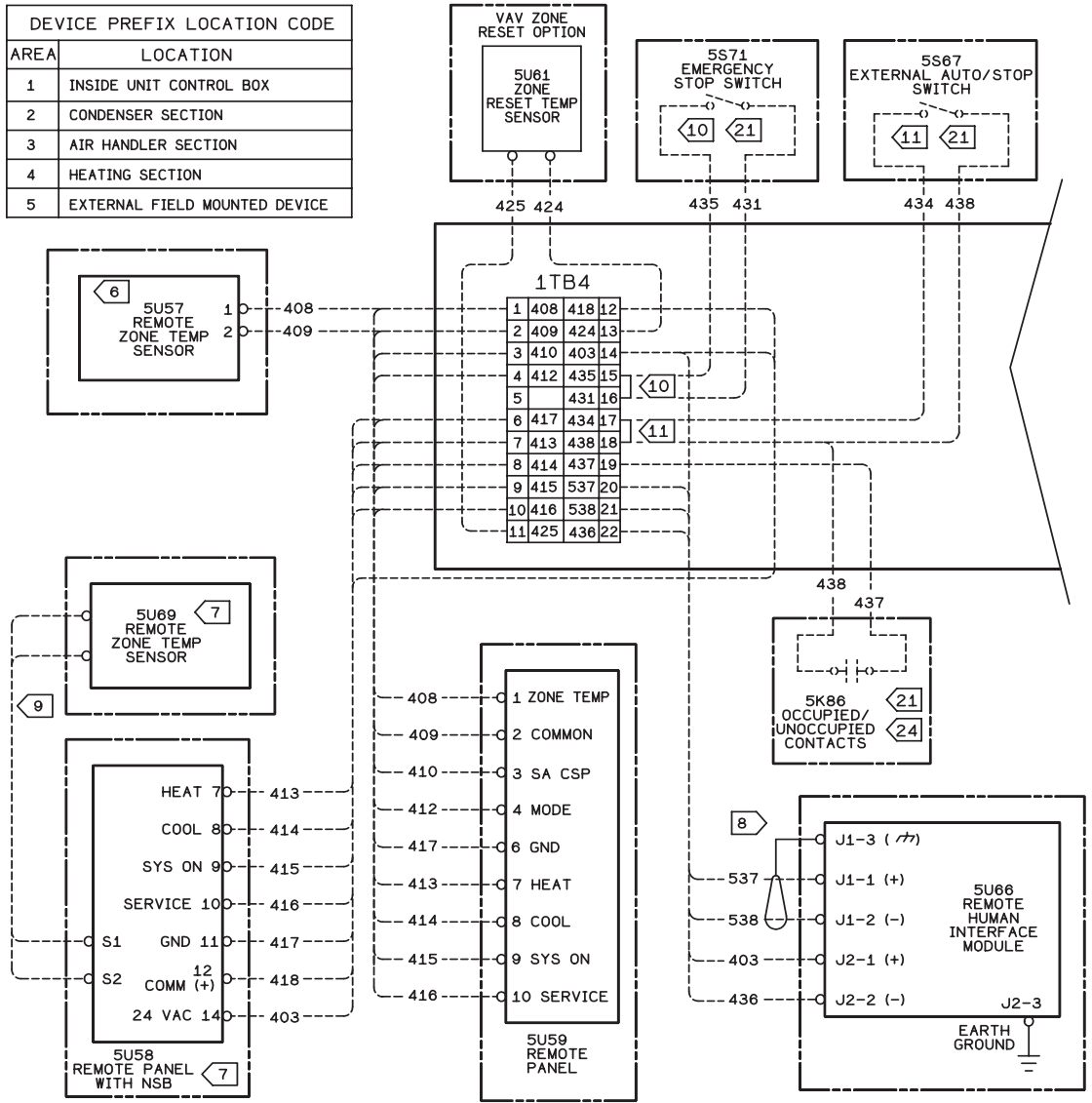
1. ALL WIRING AND COMPONENTS SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL ELECTRICAL CODES.
2. CUSTOMER CONNECTIONS - MAIN UNIT CONTROL (CIRCUIT #1) - ARE LOCATED IN THE CONDENSER SECTION FOR 20 THRU 75 TON UNITS. CUSTOMER CONNECTIONS FOR 90 THRU 130 TON UNITS ARE LOCATED IN THE HEATING SECTION.
3. SEE CUSTOMER CONNECTION WIRE RANGE TABLE FOR ACCEPTABLE WIRE SIZES FOR CONNECTION TO MAIN UNIT TERMINAL BLOCK (1TB1/4TB2) OR DISCONNECT SWITCH (1S14/4S15).
4. WIRES TO THE OPTIONAL STEAM AND/OR HOT WATER HEAT VALVE ARE SUPPLIED WITH THE UNIT. WIRE CONNECTIONS TO THE VALVE TO BE MADE BY THE CUSTOMER.
6. OPTIONAL 5U57 REMOTE ZONE TEMP SENSOR IS USED FOR REMOTE ZONE TEMP SENSING.
7. WHEN 5U69 REMOTE ZONE TEMP SENSOR IS USED, REMOVE 5U58 INTEGRAL ZONE TEMP SENSOR ATTACHED TO TERMINALS S1 AND S2.
8. WIRES USE SHIELDED TWISTED PAIR WIRE.
9. USE SHIELDED TWISTED PAIR WIRE. WRAP SHIELDS WITH TAPE TO PREVENT CONTACT WITH GROUND.
10. REMOVE JUMPER (1TB4-15 & 1TB4-16) AND INSTALL HIGH DUCT TEMP T-STAT &/OR FIELD SUPPLIED DEVICE.
11. REMOVE JUMPER (1TB4-17 & 1TB4-18) WHEN FIELD SUPPLIED EXTERNAL AUTO/STOP SWITCH (5S67) IS INSTALLED.
13. ALARM OUTPUT SWITCHES ON ANY MANUAL RESET DIAGNOSTIC.
14. OPTIONAL HEAT MODULE AUX. TEMP (5RT16) IS USED FOR MORNING WARM-UP CONTROL ON UNITS WITH HEATING OPTION.
15. TERMINAL BLOCK 1TB17 AND ASSOCIATED WIRING REQUIRED WITH GBAS (1U51) OPTION. DEMAND LIMIT RELAY (5K89) TO BE PROVIDED BY CUSTOMER.
16. VENTILATION OVERRIDE MODE CONTACTS RATED 12MA @ 24VDC MINIMUM (5K90 - 5K91 - 5K92 - 5K93 - 5K94) TO BE PROVIDED BY CUSTOMER.
17. WIRE NODES 533 & 534 REQUIRED WITH BAS/NETWORK COMM MODULE (1U54) OPTION. USE SHIELDED TWISTED PAIR WIRE.
19. 15A FUSE REPLACEMENT IS REQUIRED FOR 50 THRU 60 TON - 0.50 KVA TRANSFORMER WITH 200V - 230V - 460V OR 575V UNIT VOLTAGE. 20A FUSE REPLACEMENT IS REQUIRED FOR 50 THRU 60 TON - 0.50 KVA TRANSFORMER WITH 380V OR 415V UNIT VOLTAGE.
21. CONTACTS RATED 12 MA @ 24VDC MINIMUM.
22. CONNECT TO 24VAC CLASS 2 CIRCUITS ONLY.
23. REMOVE JUMPER WHEN OPTIONAL FIELD SUPPLIED OUTSIDE AIR SENSOR (3RT3) IS INSTALLED AND THE UNIT DOES NOT HAVE ECONOMIZER.
24. FIELD SUPPLIED AND INSTALLED OCCUPIED/UNOCCUPIED CONTACTS (5K86) FOR USE ON UNITS WITHOUT REMOTE PANEL WITH NIGHT SETBACK (5U58).

2309-3356

Figure 3-17A
Typical Field Wiring Diagram for 20 through 130 Ton VAV Control Option

<p style="text-align: center;">⚠ WARNING</p> <p>HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING. FAILURE TO DISCONNECT POWER BEFORE SERVICING CAN CAUSE SEVERE PERSONAL INJURY OR DEATH.</p>	<p style="text-align: center;">⚠ AVERTISSEMENT</p> <p>VOLTAGE HASARDEUX! DECONNECTEZ TOUTES LES SOURCES ELECTRIQUES INCLUANT LES DISJONCTEURS SITUES A DISTANCE AVANT D'EFFECTUER L'ENTRETIEN. FAUTE DE DECONNECTER LA SOURCE ELECTRIQUE AVANT D'EFFECTUER L'ENTRETIEN PEUT ENTRAÎNER DES BLESSURES CORPORELLES SEVERES OU LA MORT.</p>	<p style="text-align: center;">⚠ CAUTION</p> <p>USE COPPER CONDUCTORS ONLY! UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS. FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.</p>
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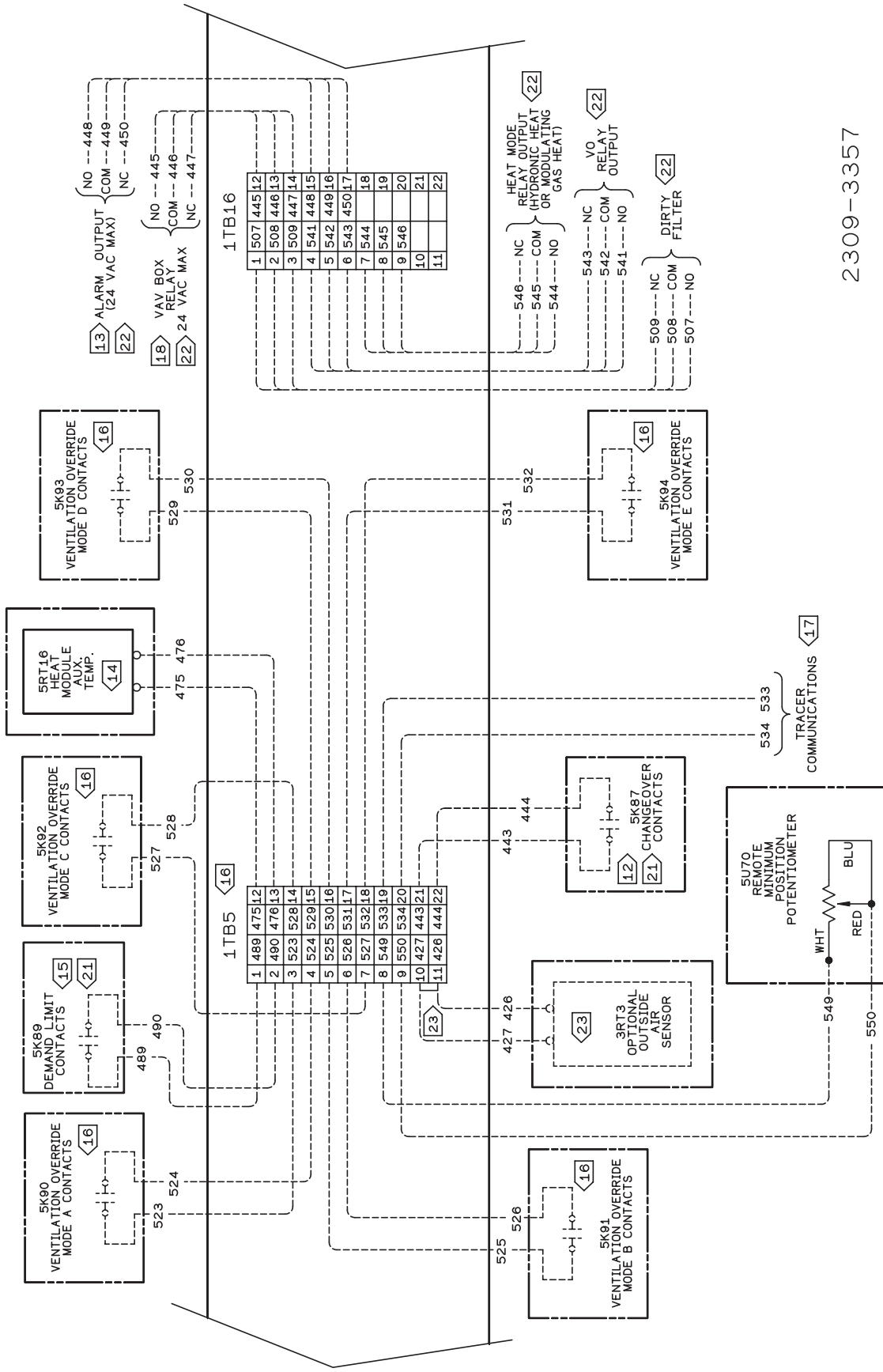
DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	INSIDE UNIT CONTROL BOX
2	CONDENSER SECTION
3	AIR HANDLER SECTION
4	HEATING SECTION
5	EXTERNAL FIELD MOUNTED DEVICE



2309-3357

Refer to Wiring Notes on page 51

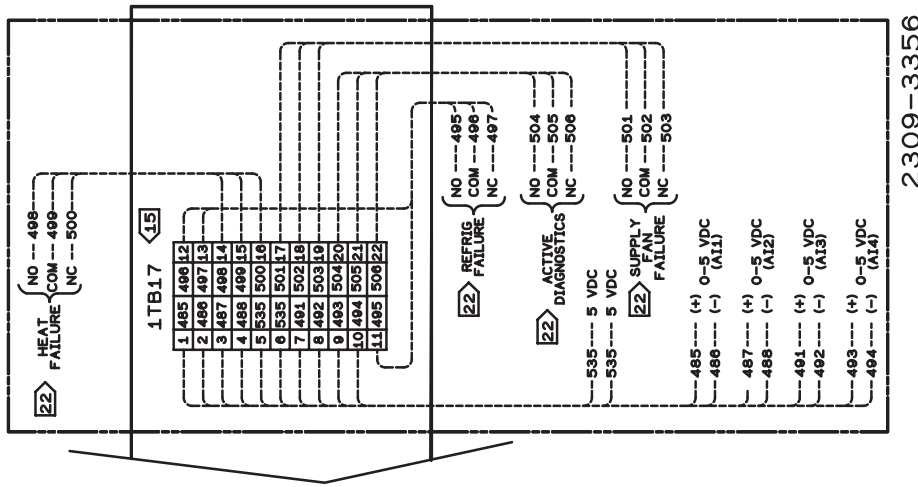
Figure 3-17B
Typical Ventilation Override Binary Output Wiring Diagram for 20 through 130 Ton VAV Control Options



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Refer to Wiring Notes on page 51

Figure 3-18
Typical GBAS Analog Input Wiring Diagram for 20 through 130 Ton CV & VAV Control Options



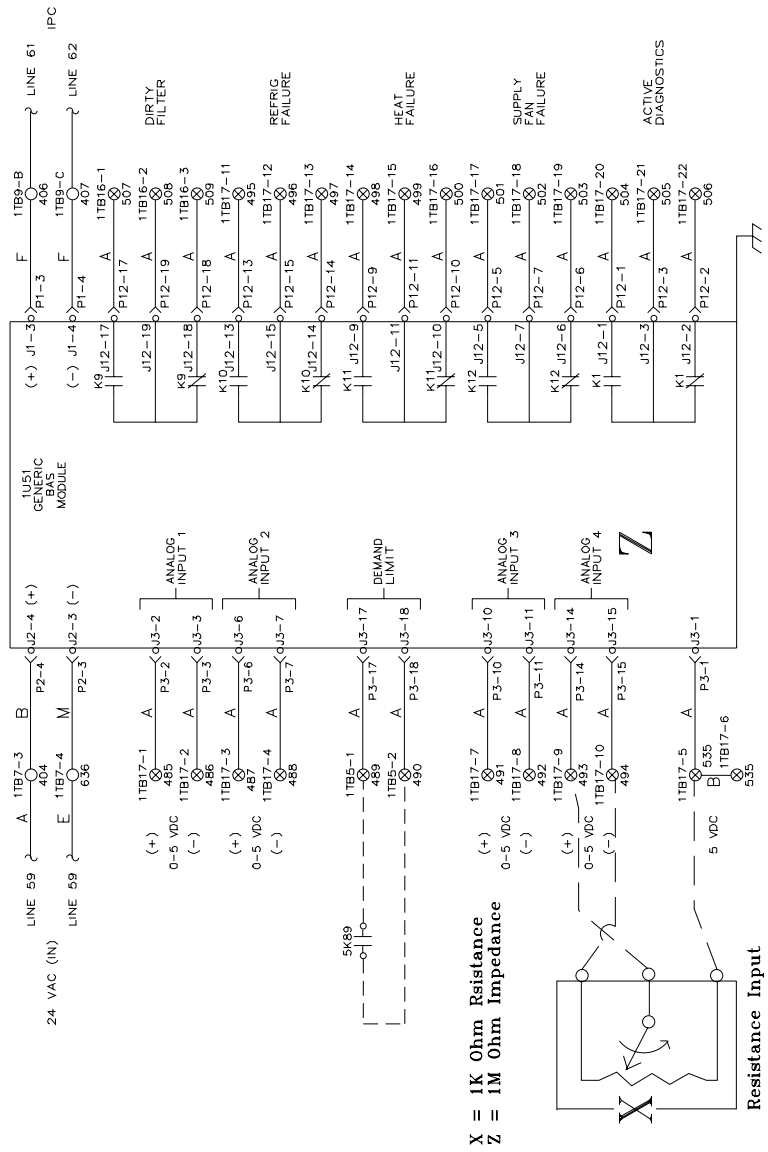
GBAS Voltage vs Setpoint

Unit Type	Input Voltage*	Setpt Range
VAV CV	0.5 to 4.5 vdc	50°F to 90°F
X	Unoccupied Zone Cooling Setpoint	50°F to 90°F
X	Occupied Zone Cooling Setpoint	50°F to 90°F
X	Occupied Zone Heating Setpoint	50°F to 90°F
X	S/A Cooling Setpoint	40°F to 90°F
X	S/A Heating Setpoint	40°F to 180°F
	(VAV Hydro Only)	
X	Space Static Pressure Setpoint	0.03 to 0.3 IWC
X	Supply Duct Static Pressure Setpoint	0.00 to 5.0 IWC

Voltage Inputs less than 0.5 will be interpreted as 0.5 vdc.

Voltage Inputs higher than 4.5 will be interpreted as 4.5 vdc.

* The actual inputted value will be displayed on the Human Interface.



X = 1K Ohm Resistance
Z = 1M Ohm Impedance

Refer to Wiring Notes on page 51

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Unit Start-Up

Cooling Sequence of Operation

Time delays are built into the controls to increase reliability and performance by protecting the compressors and maximizing unit efficiency.

Sequence of Operation

Compressor Crankcase Heaters

Each compressor is equipped with a crankcase heater and is controlled by a 600 volt auxiliary switch on the compressor contactor. The proper operation of the crankcase heater is important to maintain an elevated compressor oil temperature during the "Off" cycle to reduce oil foaming during compressor starts.

When the compressor starts, the sudden reduction in crankcase pressure causes the liquid refrigerant to boil rapidly causing the oil to foam. This condition could damage compressor bearings due to reduced lubrication and could cause compressor mechanical failures.

When power has been "Off" for an extended period, allow the crankcase heater to operate a minimum of 8 hours before starting the unit.

Units without an Economizer

Upon entering an "occupied" mode of operation, the RTM receives input from the remote panel to start the supply fan. For constant volume applications, the RTM supply fan contacts **K2** close which energizes the supply fan contactor **1K16**. Units equipped with Inlet Guide Vanes (IGV), the fan is delayed until the inlet guide vanes are driven to the full closed position. When the supply fan starts, the fan proving switch (**3S68**) closes, signaling the RTM that airflow has been established. Inlet Guide Vanes will begin to drive open (if equipped), or the VFD will begin to ramp the fan, (if equipped).

When a cooling request is sent to the RTM from a zone temperature sensor, the RTM evaluates the operating condition of the system using the supply air temperature input and the outdoor temperature input before sending the request to the SCM/MCM. Once the request is sent to the SCM/MCM, the compressor module checks the compressor protection circuit before closing "Stage 1" (**K10 on SCM or K11 on MCM**). After the first functional stage has started, the compressor module monitors the saturated refrigerant temperature and closes the condenser fan output contact "**1A**", when the saturated refrigerant temperature rises above the "lower limit" setpoint.

Units with an Economizer

Upon entering an "occupied" mode of operation, the RTM receives input from the remote panel to start the supply fan. For constant volume applications, the RTM supply fan contacts **K2** close which energizes the supply fan contactor **1K16**. Units equipped with Inlet Guide Vanes (IGV), the fan is delayed until the inlet guide vanes are driven to the full closed position. When the supply fan starts, the fan proving switch (**3S68**) closes, signaling the RTM that airflow has been established. The RTM opens the economizer dampers to the specified "minimum position".

When a cooling request is sent to the RTM from the zone temperature sensor, the RTM evaluates the operating condition of the system using the supply air temperature input and the outdoor temperature input before sending the request to the SCM/MCM for mechanical cooling. If the out-

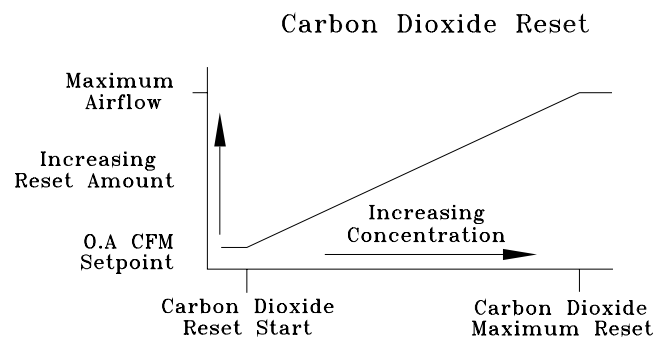
door conditions are suitable for cooling (temperature and humidity are within specified setpoints), the RTM will attempt to maintain the zone temperature without using any compressors. If the zone temperature can not be maintained within the setpoint deadband, the RTM sends a cooling request to the SCM/MCM. The compressor module checks the compressor protection circuit before closing "Stage 1" (**K10 on SCM or K11 on MCM**). After the first functional stage has started, the compressor module monitors the saturated refrigerant temperature and closes the condenser fan output contact "**1A**", when the saturated refrigerant temperature rises above the "lower limit" setpoint.

Units with Traq™ Sensor

The fresh air enters the unit through the Traq™ Sensor assembly and is measured by velocity pressure flow rings. The velocity pressure flow rings are connected to a pressure transducer/solenoid assembly. The solenoid is used for calibration purposes to compensate for temperature swings that could affect the transducer. The Ventilation Control Module (VCM) utilizes the velocity pressure input, the RTM outdoor air temperature input, and the minimum outside air CFM setpoint to modify the volume (CFM) of fresh air entering the unit as the measured airflow deviates from setpoint.

When the optional temperature sensor is installed and the Preheat function is enabled, the sensor will monitor the combined (averaged) fresh air and return air temperatures. As this mixed air temperature falls below the Preheat Actuate Temperature Setpoint, the VCM will activate the preheat binary output used to control a field installed heater. The output will be deactivated when the temperature rises 5 above the Preheat Actuate Temperature Setpoint.

When the optional CO₂ sensor is installed and the CO₂ Reset is enabled, as the CO₂ concentration increases above the CO₂ Reset Start Value, the VCM will modify the minimum outside air CFM setpoint to increase the amount of fresh air entering the unit. The setpoint will be adjusted upward until the CO₂ Maximum Reset Value is reached. The maximum effective (reset) setpoint value for fresh air entering the unit is limited to the systems operating CFM. As the CO₂ concentration decreases, the effective (reset) setpoint value is adjusted downward toward the minimum outside air CFM setpoint.



Frostat™ Control

The compressor module utilizes an evaporator temperature sensor (**3RT14 & 15**), mounted on the suction line of each circuit, to protect the evaporator from freezing. If the evaporator temperature approaches the specified setpoint, adjustable between 25 F and 35 F, the compressor(s) will be cycled "off". The compressors will not be allowed to restart until the evaporator temperature has risen 10 F above the specified cutout temperature and the compressor(s) have been off for a minimum of three minutes.

Lead/Lag Operation

When Lead/Lag is enabled, each time the system cycles after having stages 1 and 2 "On", "Stage 2" (**K11 on SCM or K3 on MCM**) and the corresponding condenser fan output "2A" will start first. The compressor module cycles the compressors "On" and "Off" to keep the zone temperature within the cooling setpoint deadband. The condenser fans are cycled "On" and "Off" to maintain the saturated refrigerant temperature within the specified controlband.

Units equipped with 100% modulating exhaust

The exhaust dampers are controlled through an Exhaust/Comparative Enthalpy Module (**ECEM**). The **ECE** module receives input from a space transducer and modulates the exhaust dampers to maintain the space pressure to within the specified setpoint controlband.

Gas Heating Sequence of Operation Standard Two Stage Gas Furnace

The control system for the rooftop units are wired to ensure that the heating and cooling do not occur simultaneously. Refer to the wiring diagram that shipped with the unit while reviewing the following sequence of operation.

Fenwal Ignition System (235 & 350 MBH Natural Gas)

When a heating requirement exists, the Rooftop Module (**RTM**) starts the supply fan and sends a request for heat to the Heat Module. The Heat Module closes **K11** contacts and starts the combustion blower motor (**4B11**). The combustion blower motor starts on low speed through the normally closed combustion fan relay (**4K33**) contacts. The heat module also closes **K12** contacts. Power is then supplied through the supply air flow switch (**4S38**), the combustion air flow switch (**4S25**), the high limit cutout (**4S26**), and finally through the normally closed sequencing time delay (**4DL6**) contacts to the pre-purge time delay relay (**4DL5**). The Fenwal ignition control board (**4U18**), the 60 second sequencing time delay relay (**4DL6**), and the combustion blower relay (**4K33**) will not energize until the pre-purge timer (**4DL5**) closes its contacts. Once closed, the Fenwal ignition control board (**4U18**) energizes the 1st stage solenoid on the gas valve (**4L15**), the interlock relay (**4K32**), and the ignition electrode (**4E1**). A second set of normally open timed closed contacts on the pre-purge timer (**4DL5**) are wired into the **1U50** heat fail input in series with a normally closed set of contacts on the interlock relay (**4K32**). When the commonly open contacts on the interlock relay (**4K32**) closes, it will maintain an electrical path for the ignition control board (**4U18**) and subsequent controls after the pre-purge timer (**4DL5**) is de-energized by the sequencing time delay relay (**4DL6**). The normally open contacts on the pre-purge time delay relay (**4DL5**) will open in the **1U50** heat fail input, preventing the Heat Fail diagnostic.

The ignition electrode (**4E1**) will spark continuously for 4.7 seconds in an attempt to establish a flame. The flame is proven by the flame rod (**4U19**). The system will operate in the low heat mode until there is an additional call for heat established by closing the **K1** contacts on the Heat Module.

The 60 second sequencing time delay relay (**4DL6**) will energize the combustion blower relay (**4K33**) which switches the combustion blower motor to high speed and energizes the 2nd stage solenoid on the gas valve (**4L15**).

If the flame rod (**4U19**) does not detect a flame at the time of an initial call for heat or detects a loss of flame during operation, it will de-energize the gas valve and the interlock relay (**4K32**). The Fenwal ignition control board (**4U18**) will lockout automatically. If a flame failure occurs prior to the sequencing time delay relay (**4DL6**) opening its contacts which de-energizes the pre-purge timer (**4DL5**), the sequencing time delay relay (**4DL6**) will complete its timing. When completed, the pre-purge time delay relay (**4DL5**) is de-energized, opening its contacts which disconnects power to the ignition control board (**4U18**), the sequencing time delay relay (**4DL6**), and the 2nd stage solenoid on the gas valve (**4L15**). Once power is removed from the ignition control board, it will reset automatically. If a call for heat still exists, after approximately 60 seconds, the contacts for the sequencing time delay relay (**4DL6**) will close, powering the pre-purge time delay circuit while timing open to the combustion blower relay (**4K33**) and the 2nd stage solenoid on the gas valve (**4L15**). The pre-purge time delay relay (**4DL5**) will initiate another ignition sequence. The combustion blower motor will continue to operate as long as a heating requirement exists and the service switch (**4S24**) is "On".

Once the heating demand has been satisfied, the combustion blower motor and the ignition control board is de-energized.

Propane Gas

Units that operate on propane gas have one additional control that affects the combustion blower motor operation when a heating demand has been initiated or satisfied. The post purge time delay relay (**4DL4**) is installed which delays the starting of the combustion blower by approximately 60 seconds. Once it has timed out, the combustion blower motor will start, closing the combustion air flow switch (**4S25**). The ignition sequence will follow the same sequence from the combustion airflow switch (**4S25**) to the subsequent controls as a natural gas system.

Once the heating demand has been satisfied, the Fenwal ignition control board (**4U18**) and the post purge time delay relay (**4DL4**) is de-energized. The combustion blower motor will continue to operate for approximately 15 seconds to purge the heat exchanger on the "Off" cycle.

Honeywell Ignition System (500 & 850 MBH Natural Gas)

When a heating requirement exists, the Rooftop Module (**RTM**) starts the supply fan and sends a request for heat to the Heat Module. The Heat Module closes **K1** contacts and starts the combustion blower motor (**4B11**). The combustion blower motor starts on low speed through the normally closed combustion blower relay (**4K33**) contacts.

The supply airflow switch (**4S38**) and the combustion air switch (**4S25**) closes. Power is applied through the high limit cutout (**4S26**) to the Honeywell ignition control board (**4U18**). The ignition control board (**4U18**) starts a pre-purge timing cycle. At the end of the pre-purge cycle, the ignition transformer (**4T7**) and the pilot solenoid valve (**4L9**) are energized. This starts a 10 second trial for pilot ignition. When the pilot flame is established and sensed by the flame sensing rod (**4U19**), stage 1 of the main gas valve (**4L7**) and the 60 seconds sequencing time delay relay (**4DL6**) is energized.

Unit Start-Up (Continued)

The system will operate in the low heat mode until there is an additional call for heat is established by closing the **K3** contacts on the Heat Module.

On Variable Air Volume systems, the sequencing time delay relay (**4DL6**) will energize the combustion blower motor relay (**4K33**) which switches the combustion blower motor to high speed and energizes the 2nd stage solenoid on the gas valve (**4L7**) after approximately 60 seconds.

If the flame rod (**4U19**) does not detect a pilot flame within the 10 second trial for ignition period, the control will lock-out. If a flame failure occurs during operation, the gas valve (**4L7**), the sequencing time delay relay (**4DL6**), and the combustion blower relay (**4K33**) is de-energized. The system will purge and attempt to relight the pilot. If a flame is not detected after this attempt, the Honeywell ignition control (**4U18**) will lock out. The combustion blower motor will continue to operate as long as a heating demand exists and the system switch (**4S24**) is "On".

Once the heating demand has been satisfied, the combustion blower and the Honeywell ignition control board (**4U18**) is de-energized.

Propane Gas

Units that operate on propane gas after 1990 have two (2) additional controls that affect the combustion blower motor operation and the sequence of the gas valve operation.

With the post purge time delay relay (**4DL4**), the additional service switch (**4S24**), and the additional 115 volt control relay (**4K31**) installed, the sequence of operation is as follows:

Power is applied to the Honeywell ignition control board (**4U18**) through the high limit switch (**4S26**). The Honeywell ignition control board (**4U18**) will sequence through its pre-purge timing and pilot ignition sequence to The post purge time delay relay (**4DL4**) delays the starting of the combustion blower motor by approximately 60 seconds. Once the timing has elapsed, the combustion blower motor will start, closing the combustion air switch (**4S25**).

Energize the control relay (**4K31**) and the sequence time delay relay (**4DL6**). 24 volts is applied from the new service switch (**4S24**) through the normally open control relay (**4K31**) contacts to energize the 1st stage solenoid on the gas valve (**4L7**).

On an additional call for heat, the **K3** contacts on the Heat Module will close to energize the combustion blower relay (**4K33**) which switches the combustion blower motor to high speed and closes its normally open contacts allowing 24 volts to energize the 2nd stage on the gas valve (**4L7**). Once the heating demand has been satisfied, the Honeywell ignition control board (**4U18**) and the post purge time delay relay (**4DL4**) is de-energized. The combustion blower motor will continue to operate for approximately 15 seconds to purge the heat exchanger on the "Off" cycle.

Modulating Gas Sequence of Operation Full and Limited Modulating Gas Furnace

The control system for the rooftop units are wired to ensure that the heating and cooling do not occur simultaneously. Refer to the modulating heat wiring diagram that shipped with the unit while reviewing the following sequence of op-

eration. As you review the sequence of operations, keep the following in mind:

1. The furnace will not light unless the manual gas valves are open and the control circuit switch **4S24** is closed.
2. The control systems are wired to ensure that heating and cooling cannot occur simultaneously.
3. The unit supply fans must run continuously so air flow switch **4S38** will stay closed.
4. Modulating Gas heat is available during both occupied and unoccupied operation.

Whenever there is a call for heat, **1U50-K1** energizes and combustion blower motor **4B11** begins to operate at High speed on the 850 and 1000 MBH heaters. The blower will operate on low speed for the 500 MBH. A relay **4K119** in parallel with the main gas valve actuator control output, insures the actuator will be open prior to proof of flame. This will force the combustion air actuator **4U82** to the open position, causing the auxiliary switch on **4U82** to close. This insures complete purging of the combustion chamber during the 60 second purge cycle.

Ignition control **IC** board **4U18** will not energize, however, unless the supply air flow switch **4S38**, combustion air flow switch **4S25**, high limit cutout **4S26**, the auxiliary switch on combustion air actuator **4U82** and the proof of closure switch on gas valve **4L22** are closed. These are all part of the safety interlock system.

With all these conditions satisfied, the **IC** board energizes and initiates an internal 60 second pre-purge time delay. When the pre-purge period expires, **4U18** energizes both the ignition transformer **4T7** and solenoid **4L9** on the intermittent pilot valve. At that point, **4U18** gives electrode **4E1** approximately 10 seconds to establish a pilot flame. (The presence of this flame is proven by flame rod **4U19**.)

If **4U18** does not detect a pilot flame at the end of this period, it will shut down and lock out the ignition / combustion circuit.

If the pilot is ignited within 10 seconds, the **IC** board de-energizes the ignition transformer **4T7** and electrode **4E1**. At this point, relay **4K119** will energize, starting the combustion air actuator and the furnace. The feedback signal from the discharge temperature sensor will cause the modulating output from the heat module to change the damper position as required to maintain the outlet temperature within the desired band.

Flame Failure

In the event that **IC** board **4U18** loses the "proof-of-flame" input signal during furnace operation, it will make one attempt at reignite. If a flame is not reestablished within the 10 second trial period, **4U18** will shut down and lock out the ignition / combustion control circuit. (Combustion blower motor **4B11** continues to run as long as a heating requirement exists and control circuit switch **4S24** is **ON**.)

Once locked out on flame failure, the **IC** board will not reactivate the ignition/combustion control circuit until it is reset manually. To do this, press the reset button on the front of the **IC** board case.

A set of relay contacts are available for external use for heat fail (Information Only).

Note: The modulating gas heaters are factory adjusted for the proper air/gas ratio at minimum and nameplate rated firing MBH for most areas in the country.

Electric Heat Sequence of Operation

The control system for the rooftop units are wired to ensure that the heating and cooling do not occur simultaneously. Refer to the electric heat wiring diagrams that shipped with the unit while reviewing the following sequence of operation. As you review the sequence of operations, remember these points:

Whenever there is a call for heat, **1U50-K1** energizes. This energizes HEAT 1 contactors **4K34** and **4K35** which, in turn, energize two of the six **4HR3** heating elements.

Note: Electric heater 4HR3 will only energize if both of the heat section's high limit safety controls—4S27 and 4S33—are closed.

1. High limit Switch **4S27** will trip if exposed to a temperature of 133 ± 5 F, and reset automatically once the temperature falls to 110 ± 5 F. It is mounted on the control-box-side of the electric heat element assembly.
2. Linear high limit **4S33** is encased in a capillary that extends across the unit's supply air opening, and is anchored near the bottom of the heat section control box. It is designed to trip if the temperature across any 6" span of the capillary exceeds 185 ± 10 F. Refer to Table 5-1.

The HEAT 2 (**4K36, 4K37**) and HEAT 3 (**4K38, 4K39**) contactors are not energized unless the 1st stage bank of heating elements already operating are not satisfying the heating load.

Wet Heat Sequence of Operation

Electrical circuitry for units with steam or hot water heat is limited to the connections associated with the modulating valve actuator (**4U15**) and the freezestat (**4S12**).

Like the furnaces described earlier, SL/SH control systems are wired to ensure that simultaneous heating and cooling do not occur. The supply fan will cycle "On" and "Off" with each call for heat during both an occupied and unoccupied period.

Whenever there is a call for heat, **1U50-K3** energizes. This allows a modulated voltage signal to be sent to the "Wet" heat actuator **4U15**. Depending on the value of this signal, **4U15** regulates the flow of steam or hot water through the coil by positioning the valve stem at some point between fully closed (6 VDC) and fully open (8.5 VDC).

Freeze Protection

A freezestat (**4S12**) is mounted inside the heat section of SLH_ and SSH_ units to prevent the "wet" heat coil from freezing during the "Off" cycle.

If the temperature of the air leaving the heating coils falls to 40 F, the freezestat's normally-open contacts close, completing the heat fail circuit on the UCM. When this occurs:

- a. The supply fan is turned "Off".
- b. "Wet" heat actuator **4U15** fully opens to allow hot water or steam to pass through the heating coil and prevent freeze-up.
- c. A "Heat Fail" diagnostic is displayed on the Human Interface LCD screen.

For heating control settings and time delay specifications, refer to Table 5-1.

Use the checklist provided below in conjunction with the "General Unit Requirement" checklist to ensure that the unit is properly installed and ready for operation. Be sure to complete all of the procedures described in this section before starting the unit for the first time.

- [] Turn the field supplied disconnect switch, located upstream of the rooftop unit, to the "Off" position.

 **WARNING**
Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

- [] Turn the 115 volt control circuit switch 1S1 to the "Off" position. It is located in the secondary of the 1T1 transformer.
- [] Turn the 24 volt control circuit switch 1S70 to the "Off" position. It is located in the secondary of the 1T2 & 1T3 transformers.
- [] Turn the "System" selection switch (at the Remote Panel) to the "Off" position and the "Fan" selection switch (if Applicable) to the "Auto" or "Off" position.
- [] Check all electrical connections for tightness and "point of termination" accuracy.
- [] Verify that the condenser airflow will be unobstructed.
- [] Check the compressor crankcase oil level. Oil should be visible in the compressor oil sight glass. The oil level should be 1/2 to 3/4 high in the sight glass with the compressor "Off".
- [] Verify that the compressor discharge service valve and the liquid line service valve is back seated on each circuit.

CAUTION
Compressor Damage!

Do not allow liquid refrigerant to enter the suction line. Excessive liquid accumulation in the liquid lines may result in compressor damage.

Compressor service valves must be fully opened before start-up (suction, discharge, liquid line, and oil line).

Do not start the unit in the cooling mode if the ambient temperature is below the following minimum recommended operating temperatures:

- Standard unit with or without HGBP -
 - +55 F for 20 & 40 Ton
 - +50 F for 25 & 30 Ton
 - +45 F for 70 thru 130 Ton
 - +40 F for 55 Ton
 - +35 F for 50 Ton
 - +30 F for 60 Ton

Unit Start-Up (Continued)

Units with Low Ambient option without HGBP - 0 F

Units with Low Ambient option with HGBP - +10 F

Note: To prevent compressor damage due to no refrigerant flow, do not pump the system down with the compressor(s) below 7 PSIG under any circumstance.

- [] Check the supply fan belts for proper tension and the fan bearings for sufficient lubrication. If the belts require adjustment, or if the bearings need lubricating, refer to the Service/Maintenance section of this manual for instructions.
- [] Inspect the interior of the unit for tools and debris. Install all panels in preparation for starting the unit.

Electrical Phasing

Unlike traditional reciprocating compressors, scroll compressors are phase sensitive. Proper phasing of the electrical supply to the unit is critical for proper operation and reliability.

The compressor motor is internally connected for clockwise rotation with the incoming power supply phased as A, B, C.

Proper electrical supply phasing can be quickly determined and corrected before starting the unit by using an instrument such as an Associated Research Model 45 Phase Sequence Indicator and following the steps below:

- [] Turn the field supplied disconnect switch that provides power to terminal block 1TB1 or to the unit mounted disconnect switch 1S14 to the "Off" position.
- [] Connect the phase sequence indicator leads to the terminal block or unit mounted disconnect switch as follows;

Phase Sequence Leads	Unit Power Terminal
Black (phase A)	L1
Red (phase B)	L2
Yellow (Phase C)	L3

- [] Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.

 **WARNING**
Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14.

- [] Observe the ABC and CBA phase indicator lights on the face of the sequencer. The ABC indicator light will glow if the phase is ABC. If the CBA indicator light glows, open the disconnect switch or circuit protection switch and reverse any two power wires.
- [] Restore the main electrical power and recheck the phasing. If the phasing is correct, open the disconnect switch or circuit protection switch and remove the phase sequence indicator.

Voltage Supply and Voltage Imbalance

Voltage Supply

Electrical power to the unit must meet stringent requirements for the unit to operate properly. Measure each leg (phase-to-phase) of the power supply. Each reading must fall within the utilization range stamped on the unit nameplate. If any of the readings do not fall within the proper tolerances, notify the power company to correct this situation before operating the unit.



WARNING **Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

Unit Start-Up (Continued)

Voltage Imbalance

Excessive three phase voltage imbalance between phases will cause motors to overheat and eventually fail. The maximum allowable voltage imbalance is 2%. Measure and record the voltage between phases 1, 2, and 3 and calculate the amount of imbalance as follows:

$$\% \text{ Voltage Imbalance} = 100 \times \frac{AV - VD}{AV} \text{ where;}$$

$$AV \text{ (Average Voltage)} = \frac{\text{Volt 1} + \text{Volt 2} + \text{Volt 3}}{3}$$

V1, V2, V3 = Line Voltage Readings

VD = Line Voltage reading that deviates the farthest from the average voltage.

Example: If the voltage readings of the supply power measured 221, 230, and 227, the average volts would be:

$$\frac{221 + 230 + 227}{3} = 226 \text{ Avg.}$$

$$VD \text{ (reading farthest from average)} = 221$$

The percentage of Imbalance equals:

$$100 \times \frac{226 - 221}{226} = 2.2\%$$

The 2.2% imbalance in this example exceeds the maximum allowable imbalance of 2.0%. This much imbalance between phases can equal as much as a 20% current imbalance with a resulting increase in motor winding temperatures that will decrease motor life. If the voltage imbalance is over 2%, notify the proper agencies to correct the voltage problem before operating this equipment.

Table 4-1
Service Test Guide for Component Operation

COMPONENT BEING TESTED	COMPONENT CONFIGURATION													Occ Unocc Relay	
	Supply Fan	Exhaust Fan	Condenser Fans	Heat Stages			Compressor Stage				Econo Damper	Exhaust Damper	IGV		VFD Output
				1	2	3	1	2	3	4					
* COMPRESSOR															
20 thru 30 Ton															
A	Off	Off	A-Off/B-On	Off	Off	Off	K10-Off	K11-On	N/A	N/A	Closed	Closed	Closed	0%	Default
B	Off	Off	A-On/B-Off	Off	Off	Off	K10-On	K11-Off	N/A	N/A	Closed	Closed	Closed	0%	Default
40 thru 60 Ton															
1A	Off	Off	1A-Off/1B-On 2A-Off/2B-Off	Off	Off	Off	K11-Off	K3-Off	K12-On	K4-Off	Closed	Closed	Closed	0%	Default
1B	Off	Off	1A-On/1B-Off 2A-Off/2B-Off	Off	Off	Off	K11-On	K3-Off	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
2A	Off	Off	1A-Off/1B-Off 2A-Off/2B-On	Off	Off	Off	K11-Off	K3-Off	K12-Off	K4-On	Closed	Closed	Closed	0%	Default
2B	Off	Off	1A-Off/1B-Off 2A-On/2B-Off	Off	Off	Off	K11-Off	K3-On	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
70 thru 105 Ton															
1A & 1B	Off	Off	1A-Off/1B-On 2A-Off/2B-Off	Off	Off	Off	K11-Off	K3-Off	K12-On	K4-Off	Closed	Closed	Closed	0%	Default
1C	Off	Off	1A-On/1B-Off 2A-Off/2B-Off	Off	Off	Off	K11-On	K3-Off	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
2A & 2B	Off	Off	1A-Off/1B-Off 2A-Off/2B-On	Off	Off	Off	K11-Off	K3-Off	K12-Off	K4-On	Closed	Closed	Closed	0%	Default
2C	Off	Off	1A-Off/1B-Off 2A-On/2B-Off	Off	Off	Off	K11-Off	K3-On	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
115 thru 130 Ton															
1A & 1B	Off	Off	1A-Off/1B-On 2A-Off/2B-Off	Off	Off	Off	K11-Off	K3-Off	K12-On	K4-Off	Closed	Closed	Closed	0%	Default
1C & 1D	Off	Off	1A-On/1B-Off 2A-Off/2B-Off	Off	Off	Off	K11-On	K3-Off	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
2A & 2B	Off	Off	1A-Off/1B-Off 2A-Off/2B-On	Off	Off	Off	K11-Off	K3-Off	K12-Off	K4-On	Closed	Closed	Closed	0%	Default
2C & 2D	Off	Off	1A-Off/1B-Off 2A-On/2B-Off	Off	Off	Off	K11-Off	K3-On	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
** CONDENSER FANS															
20 Ton															
A-2B1	Off	Off	A-On/B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
B-2B2	Off	Off	A-Off/B-On	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
25 - 30 Ton															
A-2B1	Off	Off	A-On/B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
B-2B2/2B3	Off	Off	A-Off/B-On	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
40 Ton															
1A-2B1	Off	Off	1A-On/1B-Off 2A-Off/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
1B-2B2	Off	Off	1A-Off/1B-On 2A-Off/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
2A-2B4	Off	Off	1A-Off/1B-Off 2A-On/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
2B-2B5	Off	Off	1A-Off/1B-Off 2A-Off/2B-On	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
50 & 55 Ton															
1A-2B1	Off	Off	1A-On/1B-Off 2A-Off/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
1B-2B2/2B3	Off	Off	1A-Off/1B-On 2A-Off/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
2A-2B4	Off	Off	1A-Off/1B-Off 2A-On/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
2B-2B5/2B6	Off	Off	1A-Off/1B-Off 2A-Off/2B-On	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
60 thru 75 Ton															
1A-2B1	Off	Off	1A-On/1B-Off 2A-Off/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
1B-2B2/2B3	Off	Off	1A-Off/1B-On 2A-Off/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
2A-2B4	Off	Off	1A-Off/1B-Off 2A-On/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
2B-2B5/2B6	Off	Off	1A-Off/1B-Off 2A-Off/2B-On	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default

Refer to the next page for applicable notes.

Table 4-1 (Continued)
Service Test Guide for Component Operation

COMPONENT BEING TESTED (Cont.)	COMPONENT CONFIGURATION													Occ Unocc Relay	
	Supply Fan	Exhaust Fan	Condenser Fans	Heat Stages			Compressor Stage				Econo Damper	Exhaust Damper	IGV		VFD Output
				1	2	3	1	2	3	4					
** CONDENSER FANS															
90 Ton															
1A-2B3/2B14	Off	Off	1A-On/1B-Off 2A-Off/2B-Off	Off	Off	Off	K11-Off	K3-Off	K12-On	K4-Off	Closed	Closed	Closed	0%	Default
1B-2B1/2B2	Off	Off	1A-Off/1B-On 2A-Off/2B-Off	Off	Off	Off	K11-On	K3-Off	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
2A-2B6/2B13	Off	Off	1A-Off/1B-Off 2A-On/2B-Off	Off	Off	Off	K11-Off	K3-Off	K12-Off	K4-On	Closed	Closed	Closed	0%	Default
2B-2B4/2B5	Off	Off	1A-Off/1B-Off 2A-Off/2B-On	Off	Off	Off	K11-Off	K3-On	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
105 & 115 Ton															
1A-2B3/2B14	Off	Off	1A-On/1B-Off 2A-Off/2B-Off	Off	Off	Off	K11-Off	K3-Off	K12-On	K4-Off	Closed	Closed	Closed	0%	Default
1B-2B1/2B2/2B19	Off	Off	1A-Off/1B-On 2A-Off/2B-Off	Off	Off	Off	K11-On	K3-Off	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
2A-2B6/2B13	Off	Off	1A-Off/1B-Off 2A-On/2B-Off	Off	Off	Off	K11-Off	K3-Off	K12-Off	K4-On	Closed	Closed	Closed	0%	Default
2B-2B4/2B5/2B15	Off	Off	1A-Off/1B-Off 2A-Off/2B-On	Off	Off	Off	K11-Off	K3-On	K12-Off	K4-Off	Closed	Closed	Closed	0%	Default
130 Ton															
1A-2B3/2B14	Off	Off	1A-On/1B-Off 2A-Off/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
1B-2B1/2B2 2B19/2B20	Off	Off	1A-Off/1B-On 2A-Off/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
2A-2B6/2B13	Off	Off	1A-Off/1B-Off 2A-On/2B-Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
2B-2B4/2B5 2B15/2B21	Off	Off	1A-Off/1B-Off 2A-Off/2B-On	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
SUPPLY FAN	On	Off	All Off	Off	Off	Off	Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
EXHAUST FAN	Off	On	All Off	Off	Off	Off	Off	Off	Off	Off	Closed	100% Open	100% Open	100%	Default
GAS HEAT (Full Cap.)	On	Off	All Off	On	On	N/A	Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Stage 1	On	Off	All Off	On	Off	N/A	Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Stage 2	On	Off	All Off	Off	On	N/A	Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Full Modulating (High Fire Adjustment)	On	Off	All Off	90% Select			Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Full Modulating (Low Fire Adjustment)	On	Off	All Off	5% Select			Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Limited Modulating (High Fire Adjustment)	On	Off	All Off	90% Select			Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Limited Modulating (Low Fire Adjustment)	On	Off	All Off	33% Select			Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
ELECTRIC HEAT	On	Off	All Off	On	On	On	Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Stage 1	On	Off	All Off	On	Off	Off	Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Stage 2	On	Off	All Off	Off	On	Off	Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Stage 3	On	Off	All Off	Off	Off	On	Off	Off	Off	Off	Closed	Closed	100% Open	100%	Unocc
Hydronic Heat	Off	Off	All Off	100% Select			Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
Pre - Heater	Off	Off	All Off	On	N/A	N/A	Off	Off	Off	Off	Closed	Closed	Closed	0%	Default
Fresh Air Dampers	Off	Off	All Off	Off	Off	Off	Off	Off	Off	Off	100% Open	Closed	Closed	0%	Default
Exhaust Dampers	Off	Off	All Off	Off	Off	Off	Off	Off	Off	Off	100% Open	100% Open	Closed	0%	Default

* - Compressors for the 20 thru 60 Ton units can operate individually or together and in any order while in the SERVICE TEST mode. Compressors 1A & 1B and compressors 2A & 2B operate simultaneously within their respective circuits on the 70 thru 105 Ton units. Compressors 1A & 1B, 1C & 1D, 2A & 2B, 2C & 2D operate simultaneously within their respective circuits on 115 and 130 Ton units. **Caution:** Do Not operate the compressors for extended periods of time without the condenser fans, High Head Pressure will develop.

** - Condenser fan outputs can operate individually or together and in any order while in the SERVICE TEST mode.

*** - Once the unit has started, refer to the Status Menu in the Human Interface for the OA CFM.

**** - RTM OCC/UNOCC output in the Service Test Mode must be in the unoccupied mode to open the system VAV boxes and the Inlet Guide Vanes or to drive the VFD to 100%.

Verifying Proper Fan Rotation

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position and the "Fan" selection switch for constant volume units is in the "Auto" position. (VAV units do not utilize a "Fan" selection input.)
2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.
3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
4. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the appropriate SAHF-PTG manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
5. Use Table 4-1 to program the unit Fans for operation by scrolling through the displays. All of the Fans (Supply, Exhaust, and Condenser fans) can be programmed to be "On", if desired. Verify proper fan rotation for VFDs with bypass.

Refer to Figure 4-1 for the condenser fan locations and the Human Interface designator.

6. Once the configuration for the Fans is complete, press the NEXT key until the LCD displays the "Start test in ___Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.

WARNING **Rotating Components!**

During installation, testing, servicing and troubleshooting of this product it may be necessary to measure the speed of rotating components. Have a qualified or licensed service individual who has been properly trained in handling exposed rotating components, perform these tasks. Failure to follow all safety precautions when exposed to rotating components could result in death or serious injury.

7. Press the TEST START key to start the test. Remember that the delay designated in step 6 must elapse before the fans will begin to operate.
8. Check the supply fan and the exhaust fans (if equipped) for proper rotation. The direction of rotation is indicated by an arrow on the fan housings. Check the condenser fans for clockwise rotation when viewed from the top.

If all of the fans are rotating backwards;

- a. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.
- b. Open the field supplied disconnect switch upstream of the rooftop unit. Lock the disconnect switch in the open position while working at the unit.

Unit Start-Up (Continued)

WARNING **Hazardous Voltage!**

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

- c. Interchange any two of the field connected main power wires at the unit terminal block 1TB1 or the factory mounted disconnect switch 1S14.

Note: Interchanging "Load" side power wires at the fan contactors will only affect the individual fan rotation. Ensure that the voltage phase sequence at the main terminal block 1TB1 or the factory mounted disconnect switch 1S14 is ABC as outlined in the "Electrical Phasing" section.

If some of the fans are rotating backwards;

- a. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.
- b. Open the field supplied disconnect switch upstream of the rooftop unit. Lock the disconnect switch in the open position while working at the unit.
- c. Interchange any two of the fan motor leads at the contactor for each fan that is rotating backwards.

System Airflow Measurements

Constant Volume Systems

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position and the "Fan" selection switch for constant volume units is in the "Auto" position. (VAV units do not utilize a "Fan" selection input.)
2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.

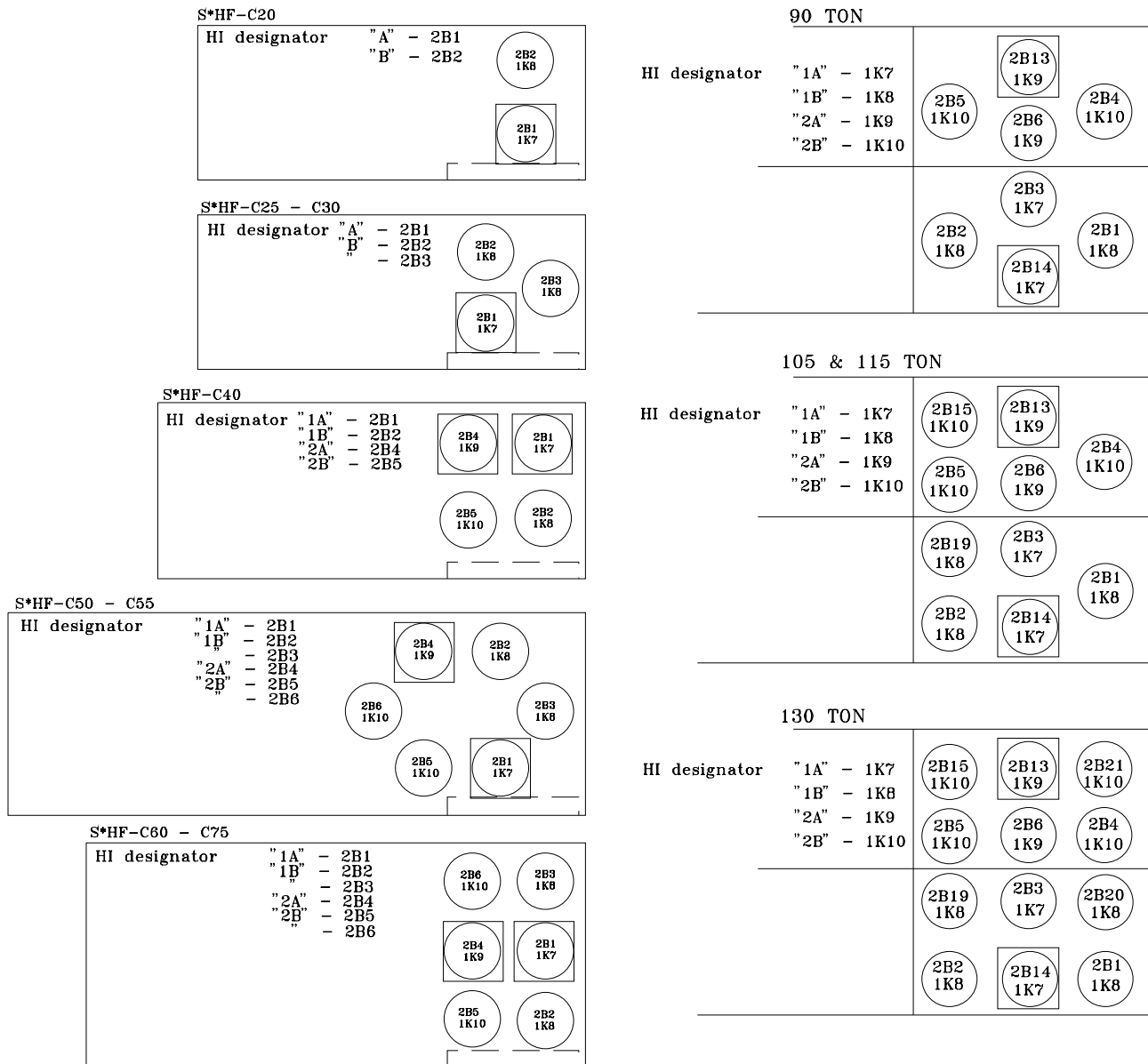
WARNING **Hazardous Voltage!**

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14.

3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
4. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the appropriate SAHF-PTG manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.

Figure 4-1
Condenser Fan Location with Human Interface Designer



5. Use Table 4-1 to program the Supply Fan for operation by scrolling through the displays.
6. Once the configuration for the Fan is complete, press the NEXT key until the LCD displays the "Start test in ___Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.

⚠ WARNING
Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

7. Press the TEST START key to start the test. Remember that the delay designated in step 6 must elapse before the fans will begin to operate.
8. With the system in the SERVICE MODE and the supply fan rotating in the proper direction, measure the amperage at the supply fan contactor 1K16 & 1K15 (additional contactor for 90 thru 130 Ton units). If the amperage exceeds the motor nameplate value, the static pressure is less than design and the airflow is too high. If the amperage is below the motor nameplate value, static pressure may be too high and CFM may be too low. To determine the actual CFM (± 5%);
 - a. Measure the actual fan RPM
 - b. Calculate the Theoretical BHP

$$\frac{\text{Actual Motor Amps} \times \text{Motor HP}}{\text{Motor Nameplate Amps}}$$
 - c. Plot this data onto the appropriate Fan Performance Curve in Figure 4-2. Where the two points intersect, read straight down to the CFM line.

Use this data to assist in calculating a new fan drive if the CFM is not at design specifications.

An alternate method with less accuracy is to measure the static pressure drop across the evaporator coil. This can be accomplished by;

- a. drilling a small hole through the unit casing on each side of the coil.

Note: Coil damage can occur if care is not taken when drilling holes in this area.

- b. Measure the difference between the pressures at both locations.
 - c. Plot this value onto the appropriate pressure drop curve in Figure 4-3. Use the data in Table 4-2 (Component Static Pressure Drops) to assist in calculating a new fan drive if the CFM is not at design specifications.
 - d. Plug the holes after the proper CFM has been established.
9. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.

Variable Air Volume Systems

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position.
2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.



WARNING Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14.

3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
4. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the appropriate SAHF-PTG manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
5. Use Table 4-1 to program the following system components for operation by scrolling through the displays;
Supply Fan
Inlet Guide Vanes (100% Open, if applicable)
Variable Frequency Drive (100% Output, if applicable)
RTM Occ/Unocc Output (Unoccupied)
6. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in __Sec." screen. Press the + key to designate the de-

Unit Start-Up (Continued)

lay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.



WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

7. Press the TEST START key to start the test. Remember that the delay designated in step 6 must elapse before the fan will begin to operate.
8. With the IGV's/VFD at 100% and the supply fan operating at full airflow capability, measure the amperage at the supply fan contactor 1K16 & 1K15 (additional contactor for 90 through 130 Ton units). If the amperage exceeds the motor nameplate value, the static pressure is less than design and the airflow is too high. If the amperage is below the motor nameplate value, static pressure may be too high and CFM may be too low. To determine the actual CFM ($\pm 5\%$);
 - a. Measure the actual fan RPM
 - b. Calculate the Theoretical BHP
$$\frac{\text{Actual Motor Amps} \times \text{Motor HP}}{\text{Motor Nameplate Amps}}$$
 - c. Plot this data onto the appropriate Fan Performance Curve in Figure 4-4. Where the two points intersect, read straight down to the CFM line.

Use this data to assist in calculating a new fan drive if the CFM is not at design specifications.

An alternate method with less accuracy is to measure the static pressure drop across the evaporator coil. This can be accomplished by;

- a. drilling a small hole through the unit casing on each side of the coil.

Note: Coil damage can occur if care is not taken when drilling holes in this area.

- b. Measure the difference between the pressures at both locations.
 - c. Plot this value onto the appropriate pressure drop curve in Figure 4-3. Use the data in Table 4-2 (Component Static Pressure Drops) to assist in calculating a new fan drive if the CFM is not at design specifications.
 - d. Plug the holes after the proper CFM has been established.
9. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.

Exhaust Airflow Measurement (Optional with all Units)

1. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.



WARNING **Hazardous Voltage!**

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14.

2. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
3. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the appropriate SAHF-PTG manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
4. Use Table 4-1 to program the following system components for operation by scrolling through the displays;
 - Exhaust Fan
 - Exhaust Dampers (100% Open, if applicable)
 - Fresh Air dampers (100% Open)
 - Variable Frequency Drive (100%, if applicable)
 - RTM Occ/Unocc Output (Default)
5. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in __Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.



WARNING **Live Electrical Components!**

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

6. Press the TEST START key to start the test. Remember that the delay designated in step 5 must elapse before the fans will begin to operate.

7. With the exhaust dampers open and the exhaust fan operating at full airflow capability, measure the amperage at the exhaust fan contactor 1K17. If the amperage exceeds the motor nameplate value, the static pressure is less than design and airflow is too high. If the amperage is below the motor nameplate value, static pressure may be too high and CFM may be too low. To determine the actual CFM ($\pm 5\%$);

- a. Measure the actual fan RPM
- b. Calculate the Theoretical BHP
$$\frac{\text{Actual Motor Amps} \times \text{Motor HP}}{\text{Motor Nameplate Amps}}$$

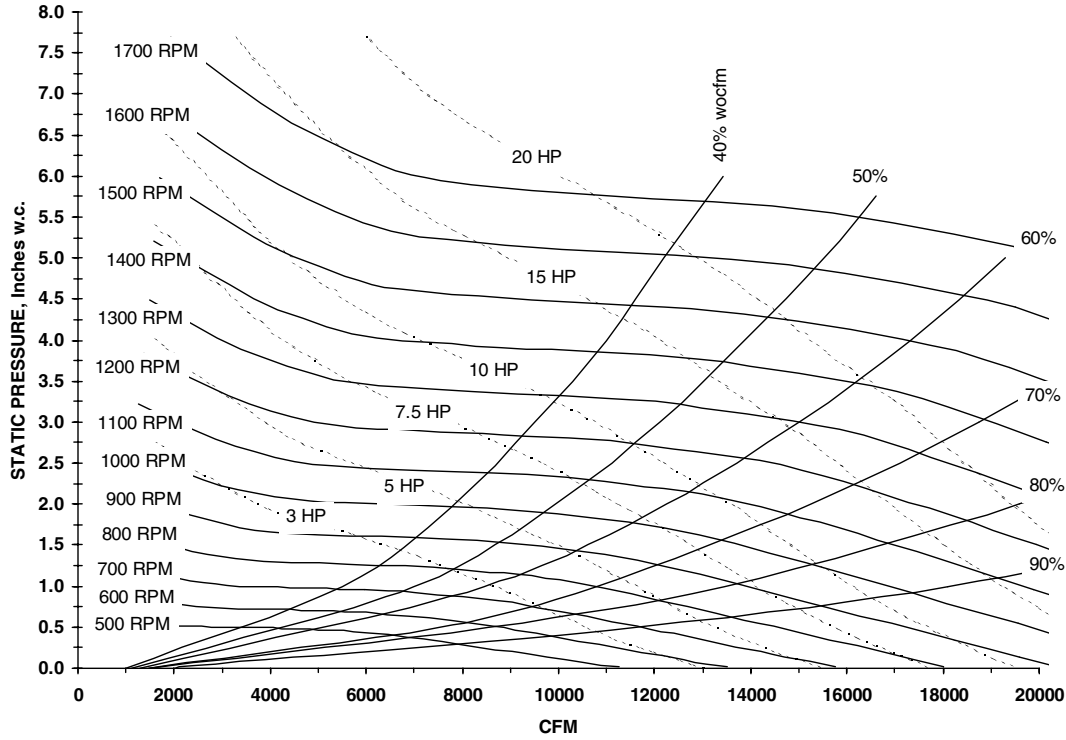
Use Tables 4-3 & 4-4 to calculate a new fan drive if the CFM is not at design specifications.

8. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.

Traq™ Sensor Airflow Measurement (Optional with all units equipped with an economizer)

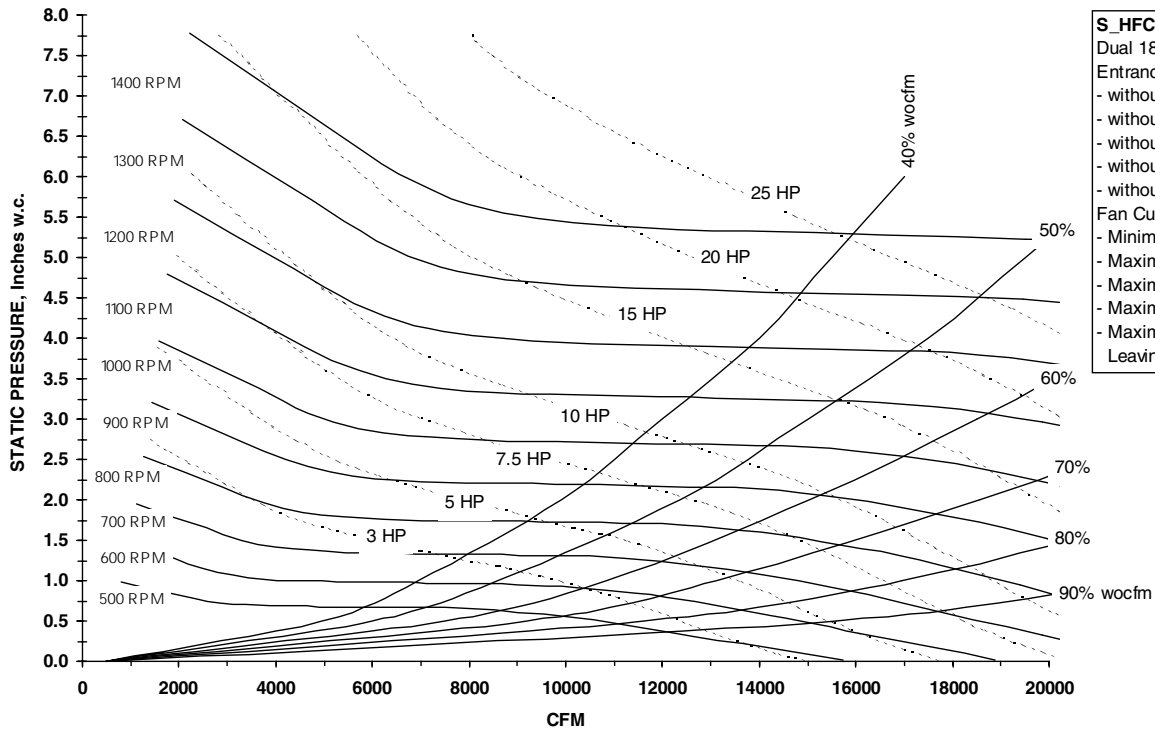
1. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the appropriate SAHF-PTG manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
2. Use Table 4-1 to program the following system components for Economizer operation by scrolling through the displays;
 - Supply Fan (On)
 - Inlet Guide Vanes (100% Open, if applicable)
 - Fresh Air dampers (Selected % Open)
 - Variable Frequency Drive (100% Output, if applicable)
 - RTM Occ/Unocc Output (Unoccupied)
 - Outside Air CFM Setpoint
 - Outside Air Pre-Heater Operation (if applicable)
3. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in __Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.
4. Press the TEST START key to start the test. Remember that the delay designated in step 3 must elapse before the fans will begin to operate.
5. With the unit operating in the "TEST MODE", the amount of outside air flowing through the traq sensor can be view by switching to the "STATUS MENU" screen "OA CFM."
6. Scroll to the "ECONOMIZER ENABLE/ECONOMIZER POSITION" screen by pressing the "NEXT" key and read the corresponding damper opening percentage (%).
7. Press the STOP key at the Human Interface Module in the unit control panel to stop the unit operation.

Figure 4-2
20 & 25 Ton Supply Fan Performance without Inlet Guide Vanes



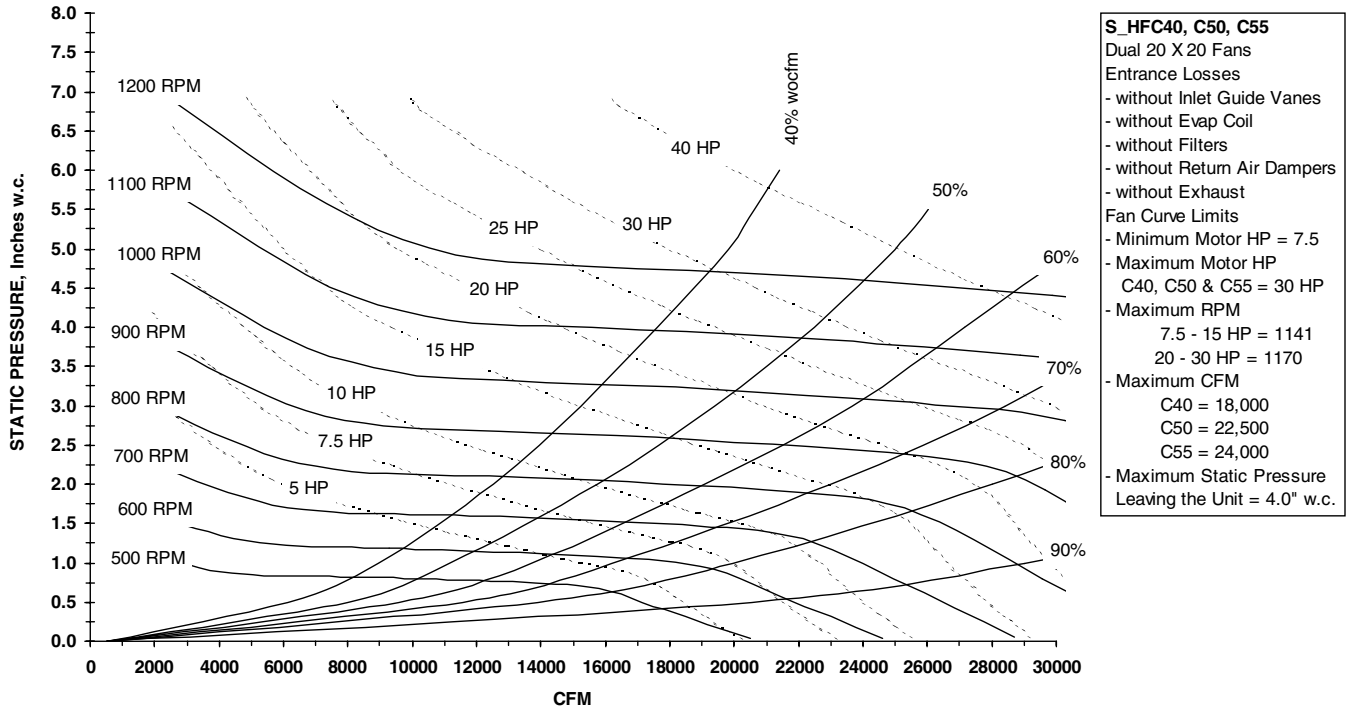
S_HFC20 & 25 Ton
 Dual 15 X 15 Fans
 Entrance Losses
 - without Inlet Guide Vanes
 - without Evap Coil
 - without Filters
 - without Return Air Dampers
 - without Exhaust Fan
 Fan Curve Limits
 - Minimum Motor HP = 3
 - Maximum Motor HP
 C20 & C25 = 15 HP
 - Maximum RPM
 3 HP - 5 HP = 1100
 7.5 HP - 15 HP = 1655
 - Maximum CFM
 C20 = 9,000
 C25 = 11,000
 - Maximum Static Pressure
 Leaving the Unit = 4.0" w.c.

30 Ton Supply Fan Performance without Inlet Guide Vanes



S_HFC30
 Dual 18 X 18 Fans
 Entrance Losses
 - without Inlet Guide Vanes
 - without Evap Coil
 - without Filters
 - without Return Air Dampers
 - without Exhaust
 Fan Curve Limits
 - Minimum Motor HP = 5
 - Maximum Motor HP = 20
 - Maximum RPM = 1379
 - Maximum CFM = 13,500
 - Maximum Static Pressure
 Leaving the Unit = 4.0" w.c.

Figure 4-2 (Continued)
40, 50 & 55 Ton Supply Fan Performance without Inlet Guide Vanes



60, 70 & 75 Ton Supply Fan Performance without Inlet Guide Vanes

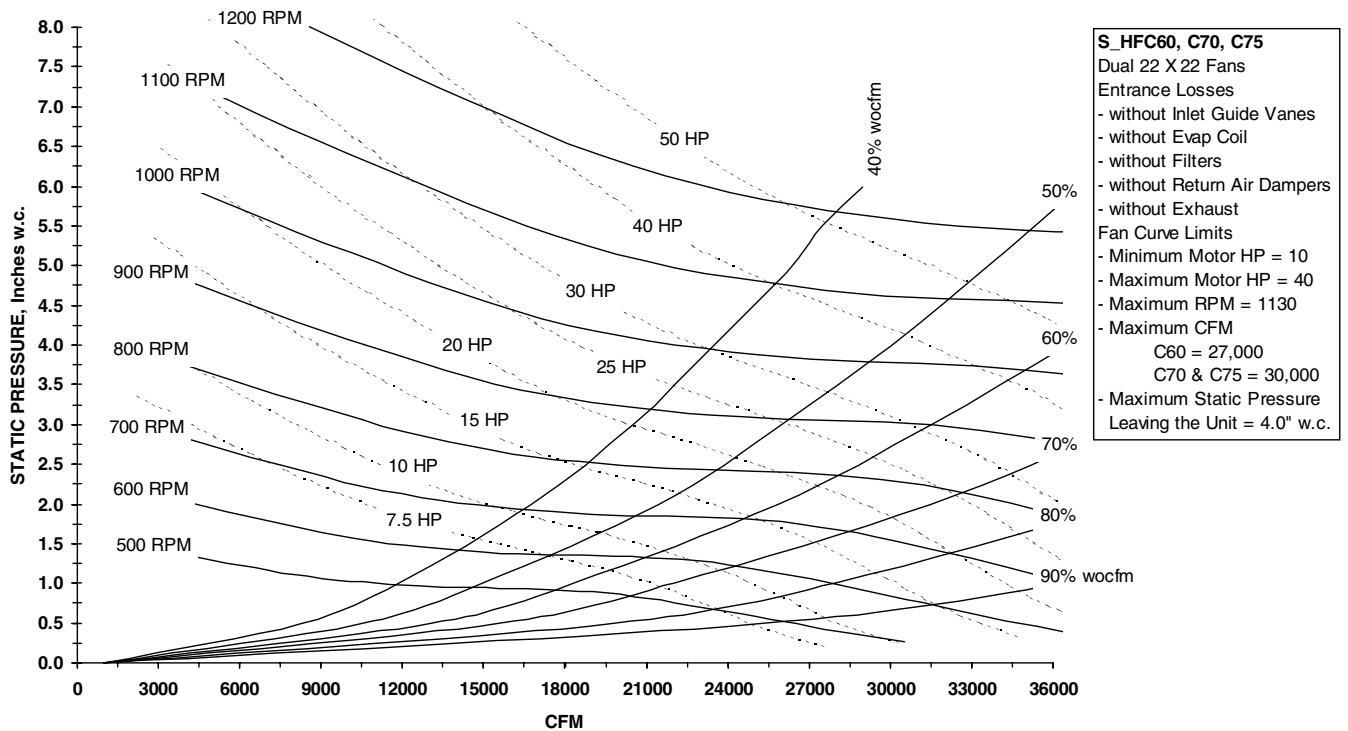


Figure 4-2 (Continued)
90, 105, 115, & 130 Ton Supply Fan Performance without Inlet Guide Vanes

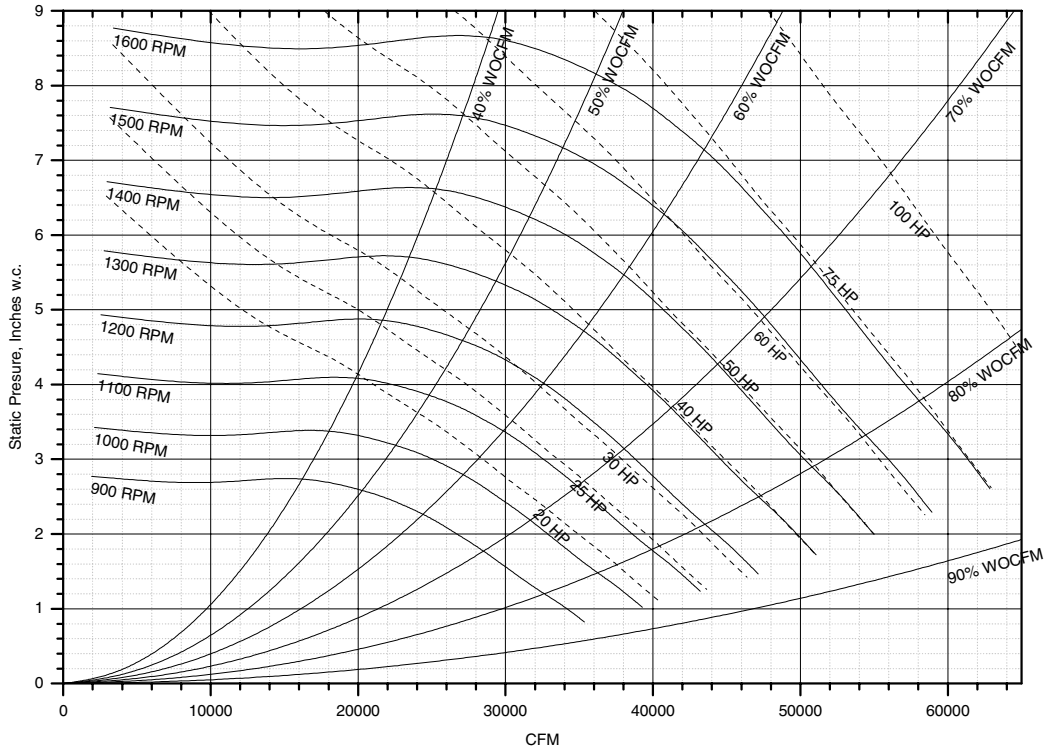
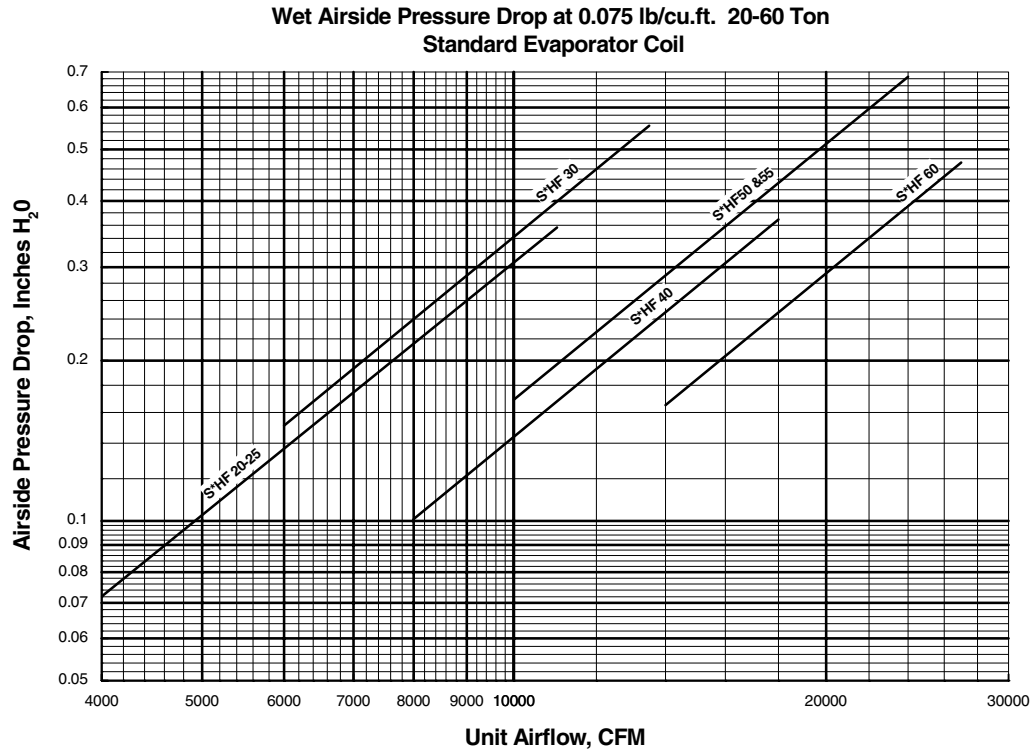


Figure 4-3
Wet Airside Pressure Drop at 0.075 lb/cu.ft. 20 through 60 Ton Standard Evaporator Coil



Dry Airside Pressure Drop at 0.075 lb/cu.ft. 20 through 60 Ton Standard Evaporator Coil

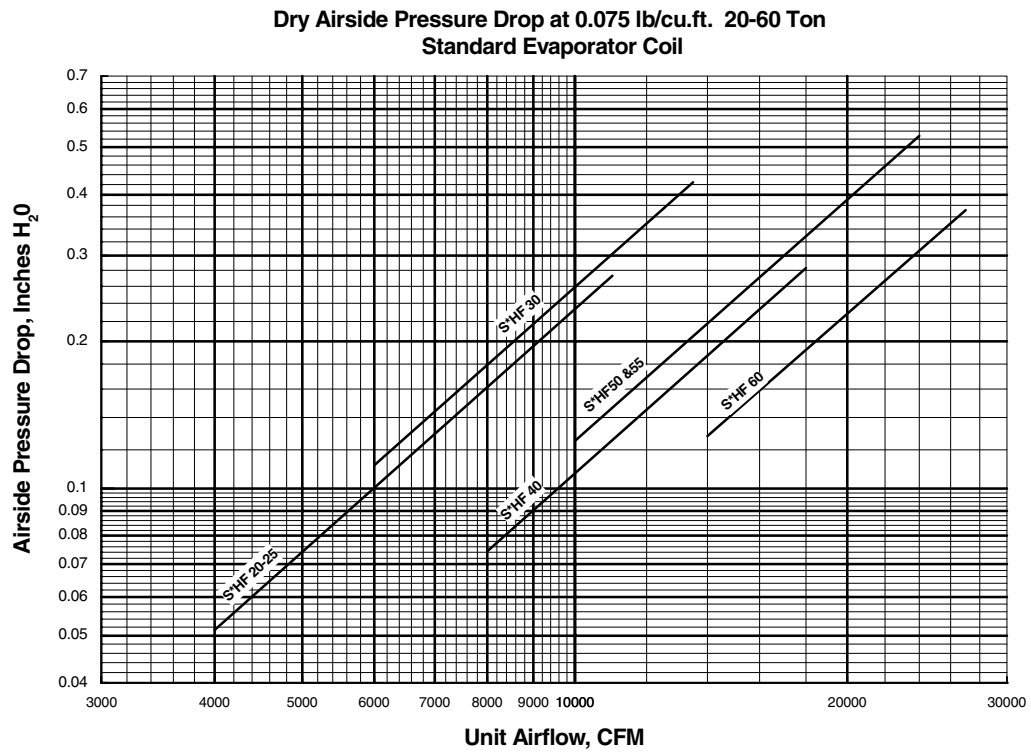
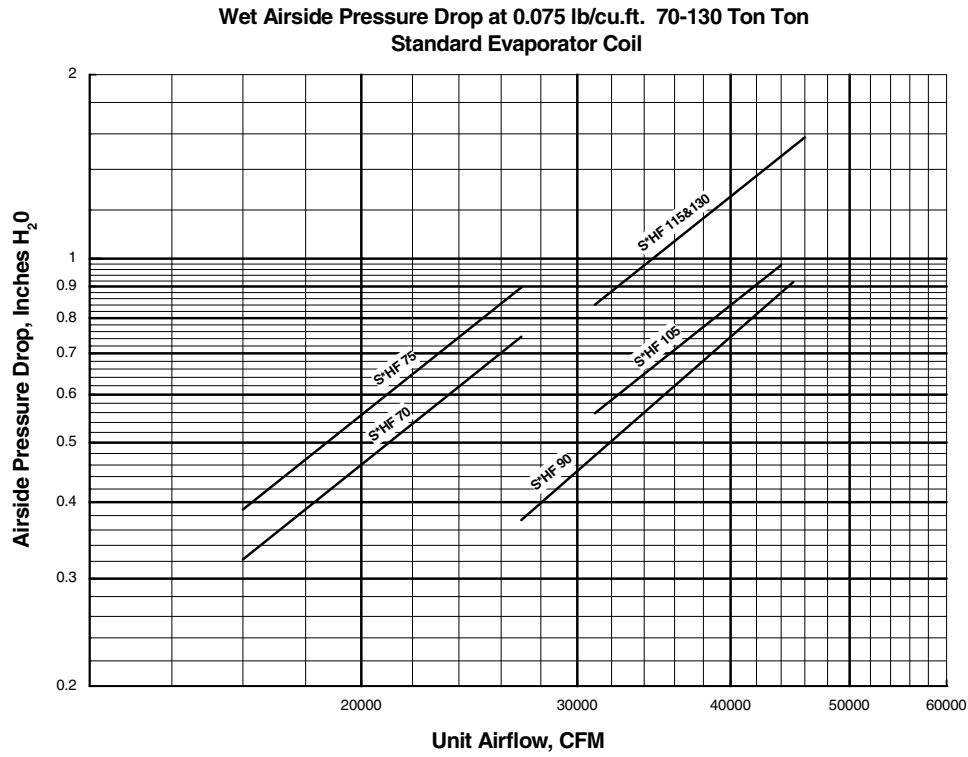


Figure 4-3 (Continued)

Wet Airside Pressure Drop at 0.075 lb/cu.ft. 70 through 130 Ton Standard Evaporator Coil



Dry Airside Pressure Drop at 0.075 lb/cu.ft. 70 through 130 Ton Standard Evaporator Coil

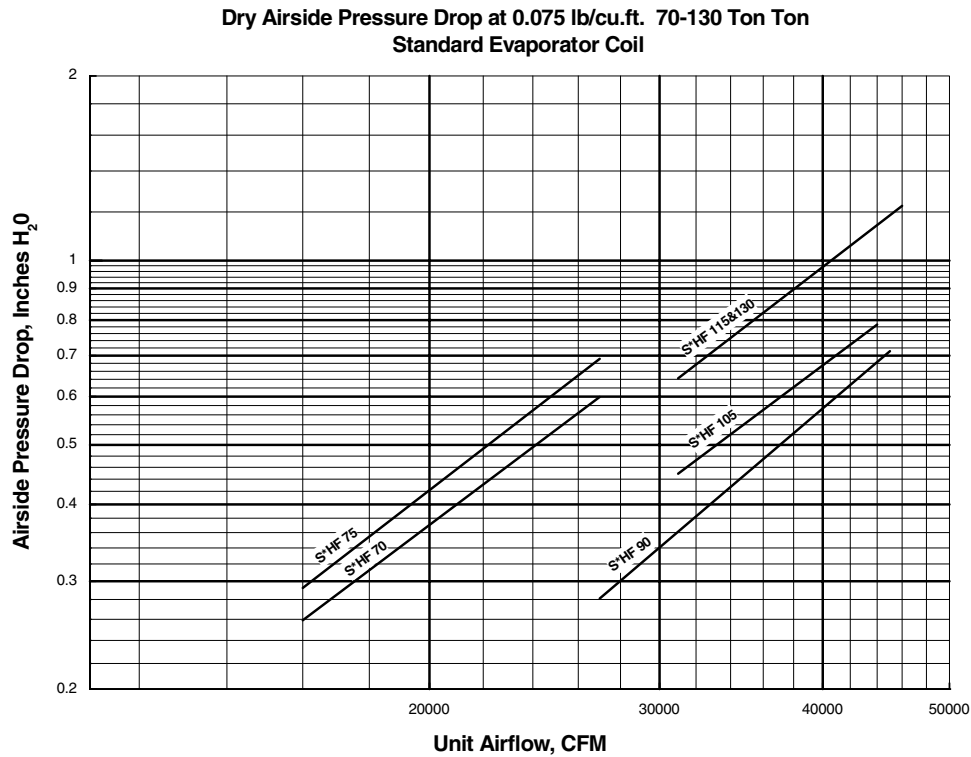
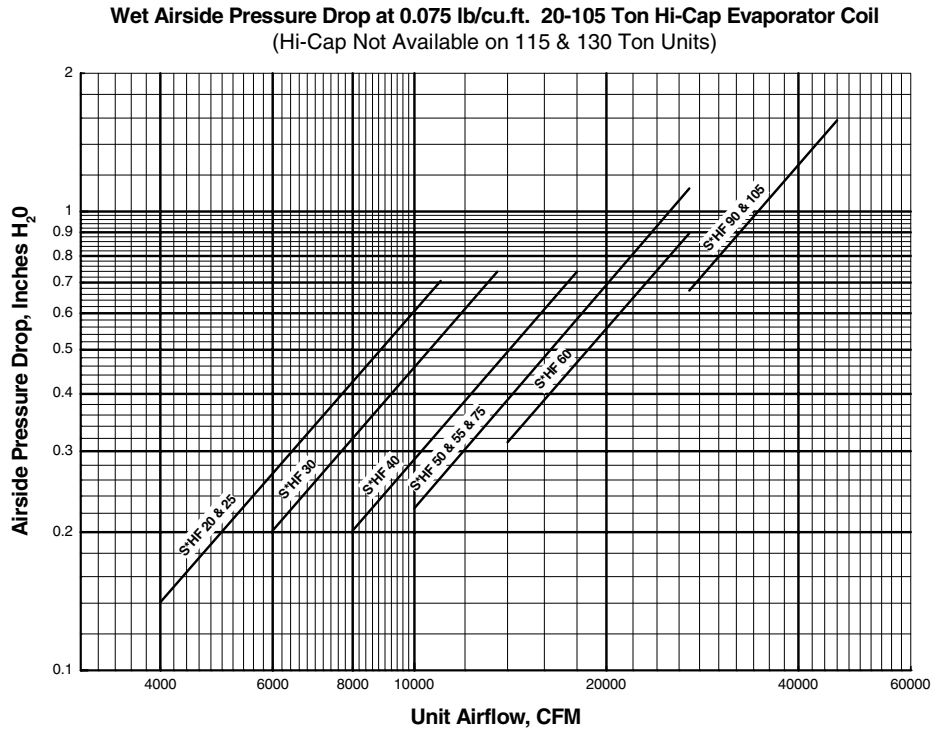


Figure 4-3 (Continued)

**Wet Airside Pressure Drop at 0.075 lb/cu.ft. 20 through 105 Ton Hi-Cap Evaporator Coil
(Hi-Cap Not Available on 115 & 130 Ton Units)**



**Dry Airside Pressure Drop at 0.075 lb/cu.ft. 20 through 105 Ton Hi-Cap Evaporator Coil
(Hi-Cap Not Available on 115 & 130 Ton Units)**

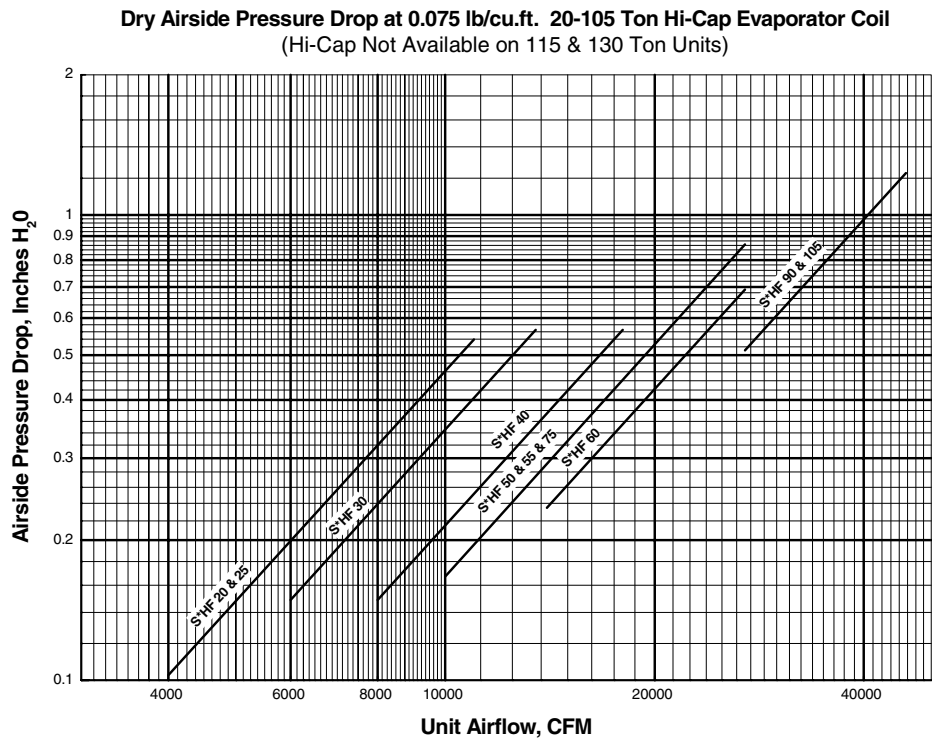
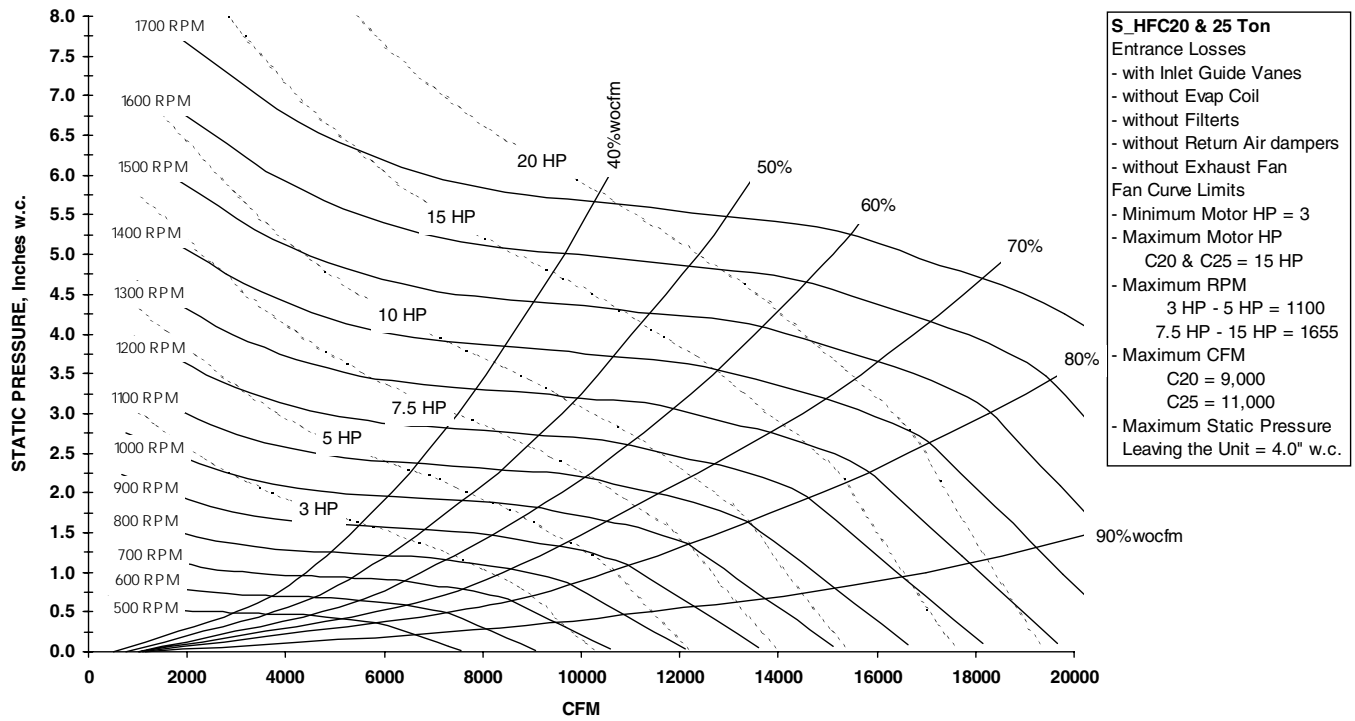


Figure 4-4
20 & 25 Ton Supply Fan Performance with Inlet Guide Vanes



30 Ton Supply Fan Performance with Inlet Guide Vanes

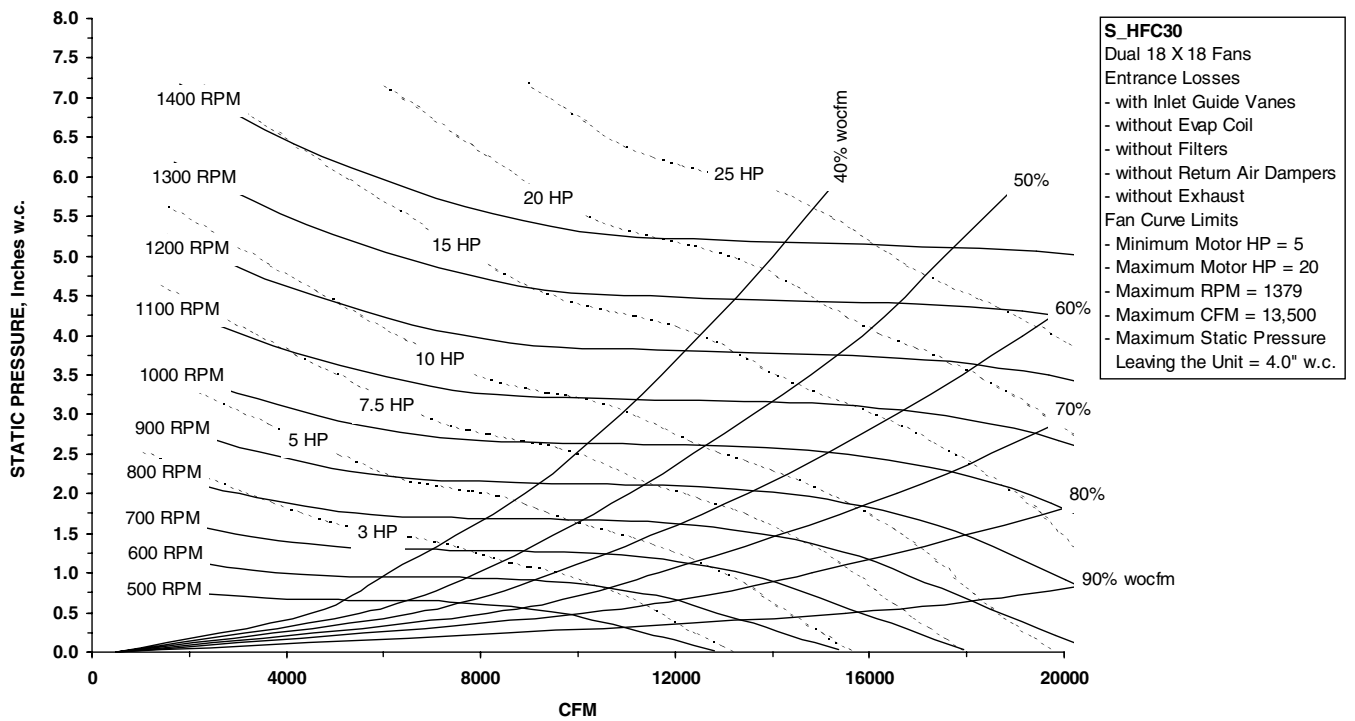
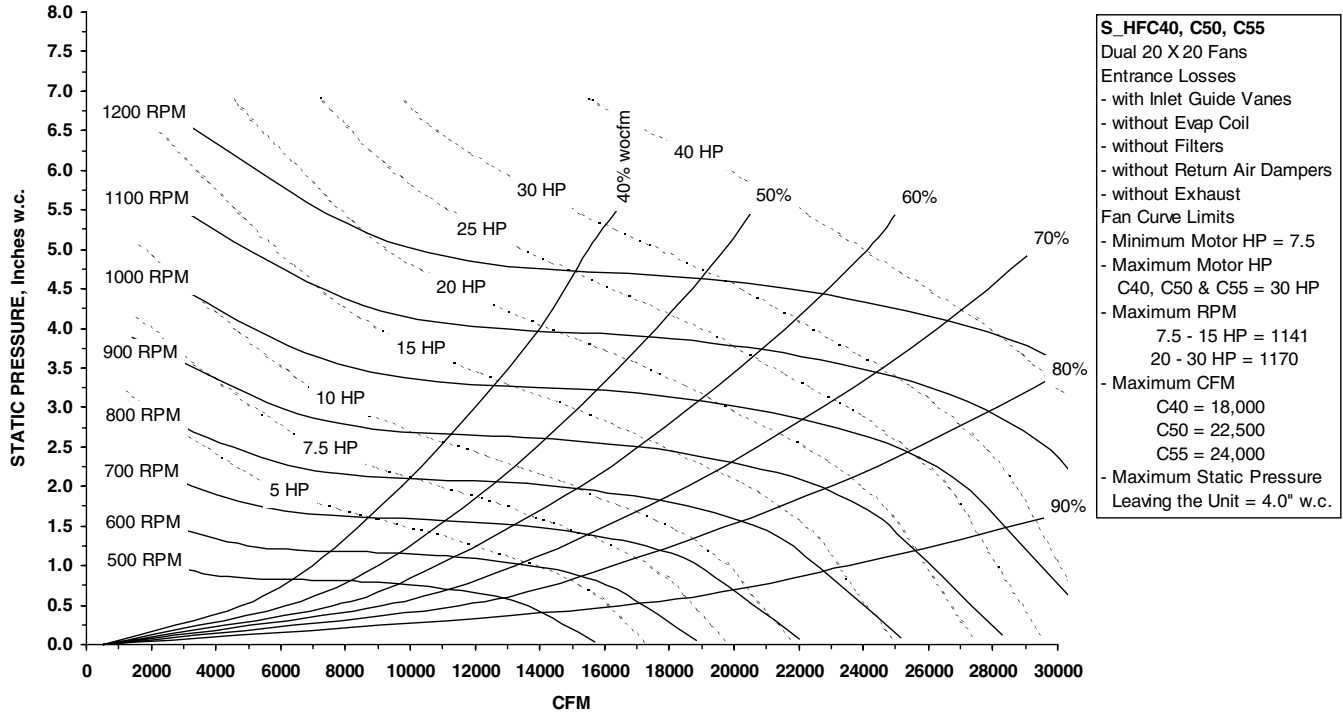


Figure 4-4 (Continued)
40, 50 & 55 Ton Supply Fan Performance with Inlet Guide Vanes



60, 70 & 75 Ton Supply Fan Performance with Inlet Guide Vanes

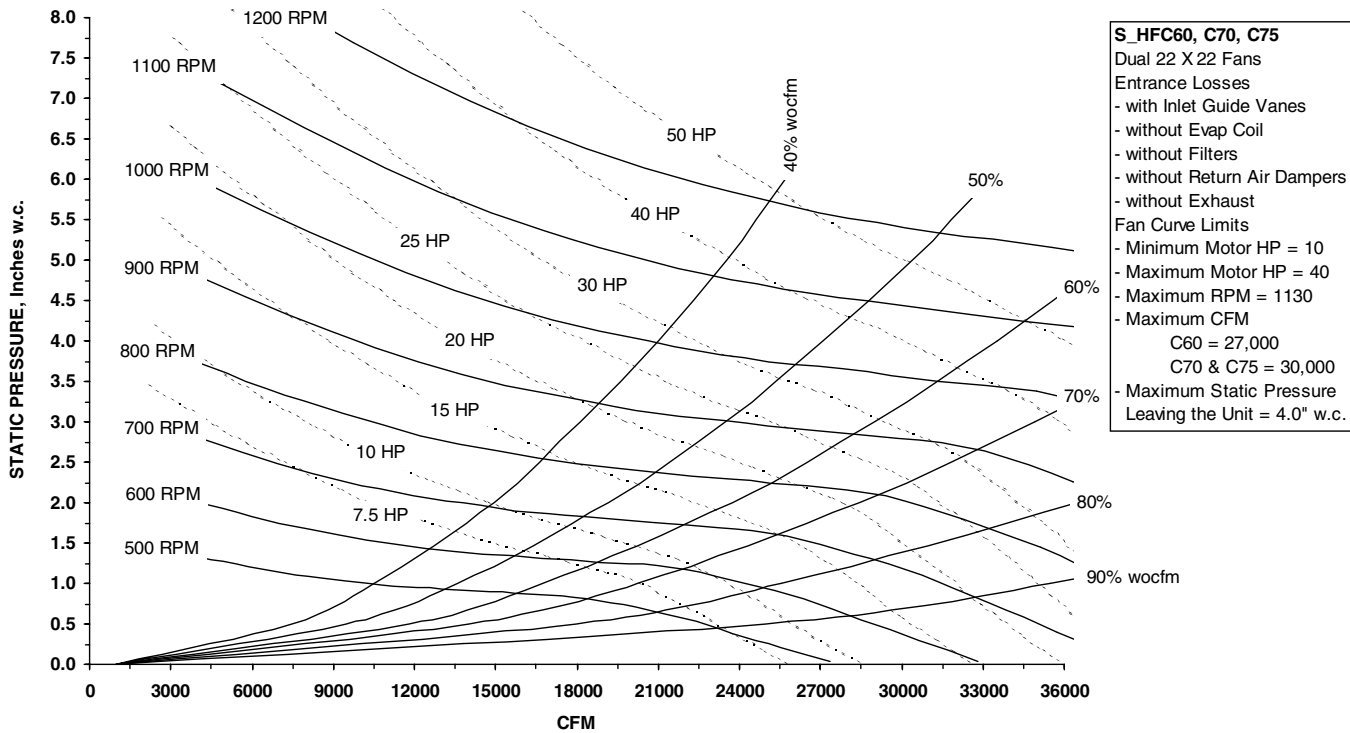


Figure 4-4 (Continued)
90, 105, 115, & 130 Ton Supply Fan Performance with Inlet Guide Vanes

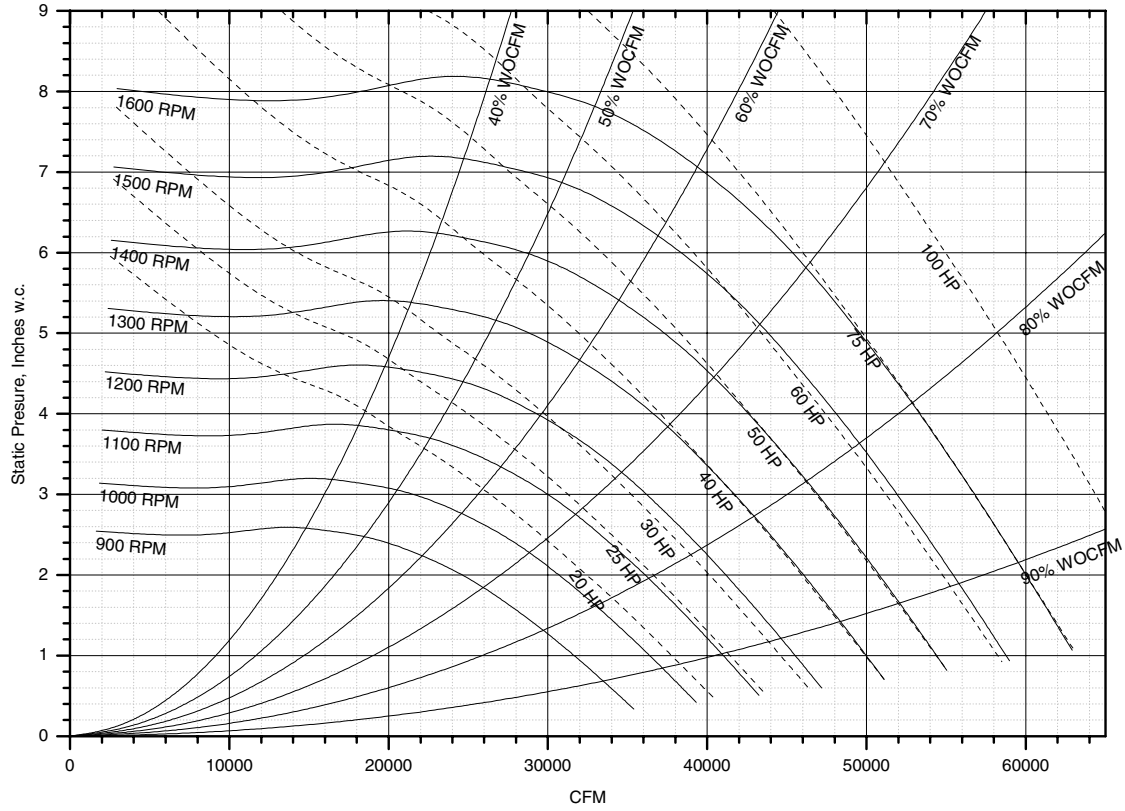


Table 4-2
20 through 75 Ton Component Static Pressure Drops (Inches W.C.)

Nom Tons	CFM STD AIR	Evaporator Coil				Heating System								Filters				Econ.	
		Std.		High Capacity		SFHF/G		SEHF/G	SLHF/G		SSHFG/G		Std.	High	Perm Wire	Bag And	Cartridge And	Std Roof	With Or Without
		Wet	Dry	Wet	Dry	Low	High	All KW's	Low	High	Low	High	Fiber	Effic.	Mesh	Prefilter	Prefilter	Curb	Exh. Fan
20	4,000	.07	.05	.14	.10	.02	N/A	.02	.05	.06	.02	.06	.03	.03	.01	.3	.24	.01	.03
	6,000	.13	.10	.27	.20	.05	.05	.04	.09	.12	.05	.12	.06	.06	.02	.5	.44	.02	.06
	8,000	.21	.16	.43	.32	.09	.09	.07	.15	.19	.10	.20	.09	.09	.03	.71	.68	.05	.12
	9,000	.26	.20	.52	.39	.12	.12	.09	.19	.24	.12	.22	.11	.11	.04	.83	.81	.07	.15
	10,000	.31	.23	.61	.46	.14	.15	.11	.23	.28	.15	.29	.13	.13	.05	.95	.95	.10	.19
	12,000	.41	.31	.82	.63	.20	.22	.17	.33	.40	.22	.42	.15	.15	.06	1.19	1.26	.14	.27
25	5,000	.10	.07	.20	.15	.03	N/A	.03	.07	.09	.04	.09	.05	.05	.02	.40	.34	.01	.03
	6,000	.13	.10	.27	.20		.05									.50	.44		
	7,500	.19	.15	.39	.29	.08	.08	.06	.14	.17	.09	.18	.09	.09	.03	.66	.62	.04	.10
	10,000	.31	.23	.61	.46	.14	.15	.11	.23	.28	.15	.29	.13	.13	.05	.95	.95	.10	.19
	11,000	.36	.27	.71	.54	.17	.18	.13	.29	.33	.19	.35	.15	.15	.06	1.06	1.11	.12	.23
	12,500	.44	.34	.87	.67	.22	.23	.18	.33	.42	.24	.42	.19	.19	.08	1.29	1.34	.19	.30
	14,000	.52	.40	1.05	.81	.28	.29	.21	.41	.53	.30	.53	.24	.24	.10			.24	.39
30	6,000	.15	.11	.20	.15	.05	.05	.04	.09	.12	.05	.12	.04	.04	.01	.34	.26	.02	.06
	9,000	.29	.22	.39	.29	.11	.12	.09	.19	.24	.12	.22	.07	.17	.02	.54	.48	.07	.15
	12,000	.46	.35	.61	.46	.20	.21	.16	.31	.39	.22	.41	.11	.11	.04	.75	.75	.16	.27
	14,000	.59	.45	.78	.60	.26	.29	.22	.40	.51	.30	.50	.14	.14	.06	.95	.95	.25	.39
	15,000	.65	.50	.87	.67	.30	.33	.25	.45	.57	.33	.52	.16	.16	.07	1.03	1.06	.30	.43
	17,000	.80	.62	1.06	.82	.39	.42	.35	.58	.73	.42	.67	.21	.21	.09	1.20	1.30	.39	.59
40	8,000	.10	.07	.20	.15	.09	N/A	.07	.09	.11	.05	.11	.04	.04	.02	.37	.31	.01	.03
	10,000	.14	.11	.29	.21		.11									.49	.43		
	12,000	.19	.14	.39	.29	.20	.15	.16	.17	.22	.11	.21	.08	.08	.03	.61	.56	.04	.07
	16,000	.31	.23	.61	.46	.34	.26	.29	.28	.36	.20	.36	.12	.12	.05	.88	.87	.10	.09
	17,000	.34	.26	.67	.51	N/A	.29	.32	.31	.39	.22	.41	.13	.13	.06	.95	.95	.12	.11
	20,000	.44	.34	.87	.67	N/A	.41	.44	.42	.52	.30	.51	.17	.17	.08	1.17	1.22	.19	.17
50/55	22,000	.51	.39	1.02	.79	N/A	.50	.53	.51	.63	.36	.62	.21	.21	.10			.23	.20
	10,000	.17	.13	.23	.17	.12	.10	.11	.13	.16	.07	.15	.04	.04	.01	.37	.30	.03	.05
	14,000	.29	.22	.39	.29	.26	.20	.22	.22	.28	.15	.28	.07	.07	.03	.56	.50	.07	.08
	17,000	.39	.30	.53	.40	.39	.29	.32	.31	.40	.22	.41	.10	.10	.04	.72	.68	.12	.11
	20,000	.51	.39	.68	.52	.58	.41	.44	.42	.52	.30	.51	.12	.12	.05	.88	.88	.19	.17
	24,000	.69	.53	.91	.70	.73	.58	.62	.48	.72	.45	.75	.16	.16	.07	1.11	1.17	.30	.23
60	28,000	.88	.68	1.17	.91	.99	.79	.84	.62	.98	.61	.99	.20	.20	.10			.39	.30
	12,000	.13	.10	.25	.18	.10	.08	.16	.10	.13	.06	.11	.05	.05	.01	.44	.37	.02	.07
	16,000	.20	.16	.39	.29	.18	.14	.29	.17	.21	.11	.19	.07	.07	.02	.63	.58	.05	.10
	20,000	.29	.23	.55	.42	.27	.21	.44	.24	.31	.16	.27	.10	.10	.03	.84	.82	.10	.16
	24,000	.39	.31	.74	.57	.40	.30	.62	.33	.42	.22	.39	.11	.11	.04	1.06	1.08	.16	.23
	28,000	.50	.39	.95	.73	.48	.33	.85	.44	.55	.32	.50	.17	.17	.06			.30	.30
70	30,000	.56	.44	1.06	.82	.62	.38	.98	.51	.63	.37	.57	.20	.20	.07			.34	.34
	12,000	.20	.16	N/A	N/A	.10	.08	.16	.10	.13	.06	.11	.05	.05	.01	.44	.37	.02	.07
	16,000	.32	.26	N/A	N/A	.18	.14	.29	.17	.21	.11	.19	.07	.07	.02	.63	.58	.05	.10
	20,000	.46	.37	N/A	N/A	.27	.21	.44	.24	.31	.16	.27	.10	.10	.03	.84	.82	.10	.16
	22,000	.54	.43	N/A	N/A	.33	.25	.53	.29	.37	.19	.33	.12	.12	.04	.95	.95	.13	.20
	24,000	.62	.50	N/A	N/A	.40	.30	.62	.33	.42	.22	.39	.14	.14	.04	1.06	1.08	.16	.23
	26,000	.70	.56	N/A	N/A	.47	.32	.73	.39	.49	.27	.45	.16	.16	.05	1.17	1.23	.23	.26
	28,000	.79	.64	N/A	N/A	.54	.33	.85	.44	.55	.32	.50	.17	.17	.06	1.22	1.29	.30	.30
75	31,000	.93	.75	N/A	N/A	.60	.40	1.04	.49	.61	.39	.55	.21	.21	.07			.37	.36
	33,000	1.03	.83	N/A	N/A	.65	.46	1.18	.52	.67	.44	.60	.24	.24	.08			.42	.40
	12,000	.25	.18	.31	.23	.10	.08	.16	.10	.13	.06	.11	.05	.05	.01	.44	.37	.02	.07
	16,000	.39	.29	.49	.37	.18	.14	.29	.17	.21	.11	.19	.07	.07	.02	.63	.58	.05	.10
	20,000	.55	.42	.69	.53	.27	.21	.44	.24	.31	.16	.27	.10	.10	.03	.84	.82	.10	.16
	22,000	.65	.49	.81	.62	.33	.25	.53	.29	.37	.19	.33	.12	.12	.04	.95	.95	.13	.20
	24,000	.74	.57	.93	.71	.40	.30	.62	.33	.42	.22	.39	.14	.14	.04	1.06	1.08	.16	.23
75	26,000	.84	.65	1.05	.81	.47	.32	.73	.39	.49	.27	.45	.16	.16	.05	1.17	1.23	.23	.26
	28,000	.95	.73	1.19	.92	.54	.33	.85	.44	.55	.32	.50	.17	.17	.06	1.22	1.29	.30	.30
	31,000	1.12	.87	1.40	1.08	.60	.40	1.04	.49	.61	.39	.55	.21	.21	.07			.37	.36
	33,000	1.24	.96	1.55	1.20	.65	.46	1.18	.52	.67	.44	.60	.24	.24	.08			.42	.40

Table 4-2 (Continued)
90 through 130 Ton Component Static Pressure Drops (Inches W.C.)

Nom Tons	CFM STD AIR	Evaporator Coil				Heating System								Filters				Econ.	
		Std.		High Capacity		SFHF/G		SEHF/G		SLHF/G		SSHF/G		Throwaway	Perm	Bag	Cartridge	Std	With Or
		Wet	Dry	Wet	Dry	Low	High	All KW's	Low	High	Low	High	Low	High	Fiber	High Effic.	Wire Mesh	And Prefilter	And Prefilter
90	27,000	.40	.31	.67	.51	N/A	.25	.13	.26	.31	.22	.32	.11	.13	N/A	.68	.65	—	.20
	32,000	.53	.41	.89	.68	N/A	.31	.16	.35	.41	.30	.43	.14	.16	N/A	.84	.84	—	.31
	37,000	.67	.52	1.12	.86	N/A	.39	.23	.45	.52	.40	.55	.17	.19	N/A	1.02	1.04	—	.41
	42,000	.82	.63	1.36	1.06	N/A	.46	.29	.56	.65	.50	.68	.21	.22	N/A	1.19	1.06	—	.52
	45,000	.92	.71	1.53	1.19	N/A	.52	.32	.63	.73	.58	.76	.24	.24	N/A	—	—	—	.63
105	31,000	.56	.45	.84	.64	N/A	.28	.17	.33	.39	.29	.40	N/A	.13	N/A	.82	.80	—	.22
	35,000	.68	.54	1.02	.78	N/A	.36	.21	.41	.48	.36	.50	N/A	.16	N/A	.96	.96	—	.32
	39,000	.81	.65	1.21	.94	N/A	.42	.26	.49	.57	.44	.60	N/A	.19	N/A	1.09	1.12	—	.44
	43,000	.94	.76	1.42	1.10	N/A	.45	.30	.57	.66	.53	.71	N/A	.22	N/A	1.22	1.30	—	.54
	46,000	1.05	.84	1.58	1.23	N/A	.55	.34	.65	.75	.61	.79	N/A	.24	N/A	—	—	—	.64
115/130	31,000	.84	.64	N/A	N/A	N/A	.28	.17	.33	.39	.29	.40	N/A	.13	N/A	.82	.80	—	.22
	35,000	1.03	.79	N/A	N/A	N/A	.36	.21	.41	.48	.36	.50	N/A	.16	N/A	.96	.96	—	.32
130	39,000	1.21	.94	N/A	N/A	N/A	.42	.26	.49	.57	.44	.60	N/A	.19	N/A	1.09	1.12	—	.44
	43,000	1.42	1.10	N/A	N/A	N/A	.45	.30	.57	.66	.53	.71	N/A	.22	N/A	1.22	1.30	—	.54
	46,000	1.58	1.23	N/A	N/A	N/A	.55	.34	.65	.75	.61	.79	N/A	.24	N/A	0	0	—	.64

Notes:

1. Static pressure drops of accessory components must be added to external static pressure to enter fan selection tables.
2. Gas heat section maximum temperature rise of 60 F.
3. Throwaway filter option limited to 300 ft/min face velocity.
4. Bag filter option limited to 740 ft/min face velocity.
5. Horizontal roof curbs assume 0.50" static pressure drop or double the standard roof curb pressure drop, whichever is greater.
6. No additional pressure loss for model SXHF.
7. 90 - 130 ton roof curbs adds no pressure drop.

Table 4-3
90 through 130 Ton 100% Modulating Exhaust Fan Performance

STD AIR CFM	Negative Static Pressure												
	0.25" W.G.		0.50" W.G.		0.75" W.G.		1.00" W.G.		1.25" W.G.		1.50" W.G.		
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	
24,000	477	7.04	513	7.95	561	9.29	604	10.66	648	12.15	693	13.83	
27,000	530	9.80	558	10.69	597	11.99	639	13.54	677	15.08	716	16.73	
30,000	584	13.24	608	14.16	637	15.34	675	16.96	712	18.67	746	20.38	
33,000	638	17.42	659	18.39	683	19.53	713	21.02	749	22.88	781	24.75	
36,000	693	22.42	711	23.46	732	24.61	756	25.99	786	27.75	818	29.80	
40,000	766	30.50	782	31.62	800	32.83	819	34.17	841	35.75	868	37.69	

STD AIR CFM	Negative Static Pressure							
	1.75" W.G.		2.00" W.G.		2.25" W.G.		2.50" W.G.	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
24,000	737	15.66	781	17.54	823	19.45	862	21.42
27,000	756	18.53	796	20.51	835	22.59	874	24.71
30,000	781	22.18	817	24.10	853	26.19	889	28.42
33,000	812	26.63	844	28.57	877	30.61	910	32.79
36,000	848	31.85	877	33.89	905	35.98	935	38.14
40,000	897	39.94	926	42.24	952	44.50	977	46.77

Note: Blocked areas identify non-standard drive selections.

Table 4-3 (Continued)
20 through 75 Ton 100% Modulating Exhaust Fan Performance

Cfm Std.	Negative Static Pressure																
	0.25" W.G.		0.50" W.G.		0.75" W.G.		1.00" W.G.		1.25" W.G.		1.50" W.G.		1.75" W.G.		2.00" W.G.		
	Air	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
S*HF-C20	4,000	399	0.38	538	0.75	640	1.08	730	1.45	811	1.87	882	2.34	947	2.88		
	6,000	453	0.74	570	1.17	675	1.65	765	2.22	845	2.78						
	8,000	547	1.59	619	1.81	711	2.48	797	3.01								
	10,000	640	2.79														
S*HF-C25	4,000	399	0.38	538	0.75	640	1.08	730	1.45	811	1.87	882	2.34	947	2.88	1017	3.55
	6,000	453	0.74	570	1.17	675	1.65	765	2.22	845	2.78	912	3.27	975	3.77	1036	4.30
	8,000	547	1.59	619	1.81	711	2.48	797	3.01	876	3.66	947	4.40				
	10,000	640	2.79	712	3.25	767	3.48	837	4.26	911	5.04						
12,000	737	4.44															
S*HF-C30	4,000	399	0.38	538	0.75	640	1.08	730	1.45	811	1.87	882	2.34	947	2.88	1017	3.55
	6,000	453	0.74	570	1.17	675	1.65	765	2.22	845	2.78	912	3.27	975	3.77	1036	4.30
	8,000	547	1.59	619	1.81	711	2.48	797	3.01	876	3.66	947	4.40	1013	5.18	1075	5.94
	10,000	640	2.79	712	3.25	767	3.48	837	4.26	911	5.04	980	5.70	1045	6.46	1106	7.31
12,000	737	4.44	806	5.22	860	5.64	905	5.89	956	6.49							
14,000	837	6.67															
S*HF-C40	7,500	334	0.75	438	1.21	535	1.77	616	2.35	686	2.98	750	3.64	809	4.34	864	5.06
	9,000	362	1.09	449	1.57	536	2.16	618	2.84	689	3.52	753	4.24	812	4.99	867	5.77
	12,000	435	2.19	496	2.70	563	3.35	628	4.04	693	4.83	757	5.71	817	6.63	873	8.53
	14,000	486	3.22	542	3.86	594	4.47	653	5.25	707	6.04	763	6.91	819	7.86	874	8.89
16,000	537	4.55	592	5.35	636	6.00	683	6.74	735	7.64	783	8.53	831	9.47	880	10.48	
S*HF-C50	9,000	362	1.09	449	1.57	536	2.16	618	2.84	689	3.52	753	4.24	812	4.99	867	5.77
	12,000	435	2.19	496	2.70	563	3.35	628	4.04	693	4.83	757	5.71	817	6.63	873	7.53
	15,000	511	3.85	567	4.56	614	5.18	667	5.96	720	6.80	771	7.66	824	8.60	876	9.63
	18,000	590	6.21	642	7.16	685	7.97	724	8.69	766	9.54	812	10.54	856	11.55	898	12.56
20,000	644	8.26	692	9.35	735	10.33	772	11.17	807	11.97	844	12.91	885	14.00	926	15.13	
S*HF-C55	10,000	386	1.40	463	1.90	540	2.48	618	3.18	691	3.94	755	4.70	814	5.48	869	6.30
	13,000	461	2.67	518	3.23	578	3.88	639	4.61	698	5.39	759	6.26	818	8.22	874	8.21
	16,000	537	4.55	592	5.35	636	6.00	683	6.74	735	7.64	783	8.53	831	9.47	880	10.48
	19,000	617	7.19	667	8.21	710	9.10	747	9.87	785	10.68	827	11.66	870	12.73	911	13.80
21,500	685	10.08	731	11.26	772	12.36	809	13.33	842	14.20	874	15.08	910	16.10	948	17.28	
S*HF-C60	12,000	351	1.49	423	2.09	502	3.00	572	4.02	634	5.07	690	6.09	740	7.04	784	7.91
C70 & -C75	15,000	412	2.68	460	3.15	521	3.96	585	5.02	646	6.24	702	7.53	754	8.83	801	10.14
	18,000	478	4.41	516	4.88	557	5.54	607	6.49	662	7.66	715	9.01	766	10.48	814	12.01
	21,000	547	6.75	578	7.36	612	7.92	647	8.71	688	9.77	735	11.03	781	12.46	827	14.03
24,000	617	9.83	644	10.59	672	11.22	702	11.88	732	12.77	766	13.89	805	15.22			

Note: Blocked areas of table identify nonstandard drive selections.

Table 4-4
20 through 75 Ton 50% Modulating Exhaust Fan Performance

	Cfm Std. Air	Negative Static Pressure													
		0.20" W.G.		0.40" W.G.		0.60" W.G.		0.80" W.G.		1.00" W.G.		1.20" W.G.		1.40" W.G.	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
S*HF-C20	2,000	364	0.17	487	0.30	582	0.45	658	0.58	731	0.73	797	0.90	856	1.08
S*HF-C25	3,000	435	0.36	522	0.51	614	0.67	694	0.88	765	1.11	830	1.34	886	1.54
	4,000	529	0.76	592	0.86	654	1.03	728	1.29	797	1.51	861	1.77	919	2.05
	5,000	623	1.32	687	1.56	735	1.67	778	1.79	836	2.13	896	2.45	953	2.72
	6,000	722	2.13	779	2.47	830	2.72	890	2.86	905	2.96				
S*HF-C30	2,000	364	0.17	487	0.30	582	0.45	658	0.58	731	0.73	797	0.90	856	1.08
	3,000	435	0.36	522	0.51	614	0.67	694	0.88	765	1.11	830	1.34	886	1.54
	4,000	529	0.76	592	0.86	654	1.03	728	1.29	797	1.51	861	1.77	919	2.05
	5,000	623	1.32	687	1.56	735	1.67	778	1.79	836	2.13	896	2.45	953	2.72
	6,000	722	2.13	779	2.47	830	2.72	870	2.86	905	2.96	944	3.16	994	3.59
	7,000	824	3.23	874	3.64	922	4.02	965	4.30	1000	4.48	1032	4.59	1062	4.72
S*HF-C40	3,000	288	0.22	393	0.38	477	0.55	547	0.74	611	0.94	668	1.16	721	1.39
	5,000	372	0.66	430	0.83	495	1.05	557	1.29	621	1.57	680	1.87	732	2.16
	7,000	472	1.55	522	1.82	563	2.04	606	2.29	653	2.59	698	2.91	742	3.24
	9,000	578	3.06	621	3.41	661	3.76	695	4.06	725	4.34	758	4.65	794	5.01
	11,000	688	5.36	725	5.80	760	6.24	793	6.66	823	7.06	850	7.42	875	7.76
S*HF-C50	3,000	288	0.22	393	0.38	477	0.55	547	0.74	611	0.94	668	1.16	721	1.39
S*HF-C55	5,000	372	0.66	430	0.83	495	1.05	557	1.29	621	1.57	680	1.87	732	2.16
	7,000	472	1.55	522	1.82	563	2.04	606	2.29	653	2.59	698	2.91	742	3.24
	9,000	578	3.06	621	3.41	661	3.76	695	4.06	725	4.34	758	4.65	794	5.01
	11,000	688	5.36	725	5.80	760	6.24	793	6.66	823	7.06	850	7.42	875	7.76
S*HF-C60	4,000	271	0.29	364	0.54	438	0.82	499	1.07	550	1.30	601	1.56	651	1.87
S*HF-C70	6,000	339	0.71	391	0.90	456	1.22	517	1.60	572	2.01	622	2.43	668	2.85
S*HF-C75	8,000	425	1.55	460	1.73	497	1.96	542	2.30	591	2.72	639	3.20	684	3.73
	10,000	517	2.88	543	3.13	571	3.34	600	3.59	632	3.94	668	4.37	707	4.87
	12,000	612	4.84	633	5.15	655	5.43	678	5.68	702	5.95	726	6.29	752	6.91
	13,000	659	6.09	679	6.44	699	6.76	720	7.04	741	7.31				

Note: Blocked areas identify non-standard motor selections.

90 through 130 Ton 50% Modulating Exhaust Fan Performance

CFM STD AIR	Negative Static Pressure											
	0.250" W.G.		0.500" W.G.		0.750" W.G.		1.000" W.G.		1.250" W.G.		1.500" W.G.	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12,000	452	3.68	495	4.21	536	4.85	576	5.46	614	6.17	651	6.95
14,000	516	5.71	551	6.21	586	6.85	622	7.63	657	8.36	690	9.09
16,000	583	8.41	609	8.85	643	9.57	672	10.29	704	11.18	735	12.07
18,000	650	11.88	672	12.29	699	12.94	729	13.79	755	14.59	782	15.56
20,000	718	16.20	737	16.62	758	17.18	785	18.03	811	18.97	835	19.86

CFM STD AIR	Negative Static Pressure							
	1.750" W.G.		2.000" W.G.		2.250" W.G.		2.500" W.G.	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12,000	687	7.73	722	8.55	759	9.46	797	10.45
14,000	723	9.96	754	10.88	785	11.79	815	12.72
16,000	764	12.84	793	13.72	822	14.72	850	15.76
18,000	811	16.62	838	17.53	864	18.41	889	19.39
20,000	859	20.87	885	22.05	910	23.18	934	24.17

Note: Blocked areas identify non-standard motor selections.

Unit Start-Up (Continued)

Economizer Damper Adjustment

Exhaust Air Dampers

Verify that the exhaust dampers (if equipped) close tightly when the unit is off. Adjust the damper linkage as necessary to ensure proper closure. An access panel is provided under each damper assembly.

Fresh Air & Return Air Damper Operation

The fresh air and return air damper linkage is accessible from the filter section of the unit. The damper linkage connecting the fresh air dampers to the return air dampers is preset from the factory in the number 1 position. Refer to Table 4-5 for the appropriate linkage position for the unit and operating airflow (CFM).



WARNING No Step Surface!

Do not walk on the sheet metal drain pan. Walking on the drain pan could cause the supporting metal to collapse. Failure of the drain pan could result in death or serious injury.

Note: Bridging between the unit's main supports may consist of multiple 2 by 12 boards or sheet metal grating.

Arbitrarily adjusting the fresh air dampers to open fully when the return air dampers are closed or; failing to maintain the return air pressure drop with the fresh air dampers when the return air dampers are closed, can overload the supply fan motor and cause building pressurization control problems due to improper CFM being delivered to the space.

The fresh air/return air damper linkage is connected to a crank arm with a series of holes that allows the installer or operator to modify the amount of fresh air damper travel in order to match the return static pressure. Refer to Table 4-5 for the equivalent return air duct losses that correspond to each of the holes illustrated in Figure 4-5.

To Adjust the Fresh Air Damper Travel:

1. Drill a 1/4" hole through the unit casing up stream of the return air dampers. Use a location that will produce an accurate reading with the least amount of turbulence. Several locations may be necessary, and average the reading.



WARNING Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14.

2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.
3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
4. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the applicable SAHF-PTG manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.
5. Use Table 4-1 to program the following system components for operation by scrolling through the displays;
 - Supply Fan (On)
 - Inlet Guide Vanes (100% Open, if applicable)
 - Variable Frequency Drive (100% Output, if applicable)
 - RTM Occ/Unocc Output (Unoccupied)
 - Fresh Air Dampers (Closed)
6. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in __Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.



WARNING Rotating Components!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

7. Press the TEST START key to start the test. Remember that the delay designated in step 6 must elapse before the fan will begin to operate.
8. With the fresh air dampers fully closed and the supply fan operating at 100% airflow requirements, measure the return static pressure at the location determined in step 1.
9. Press the STOP key at the Human Interface Module in the unit control panel to stop the fan operation.
10. Open the field supplied main power disconnect switch upstream of the rooftop unit. Lock the disconnect switch in the "Open" position while working on the dampers.
11. Compare the static pressure reading to the static pressure ranges and linkage positions in Table 4-5 for the unit size and operating CFM.

Unit Start-Up (Continued)

To relocate the fresh air/return air connecting rod to balance the fresh air damper pressure drop against the return static pressure, use the following steps. If no adjustment is necessary, proceed to step 17.

12. Remove the drive rod and swivel from the crank arm(s).
If only one hole requires changing, loosen only that end.
13. Manually open the return air dampers to the full open position.
14. Manually close the fresh air dampers.

15. Reattach the drive rod and swivel to the appropriate hole(s). The length of the drive rod may need to be adjusted to align with the new hole(s) location. If so, loosen the lock nut on the drive rod against the swivel. Turn the swivel "in" or "out" to shorten or lengthen the rod as necessary. For some holes, both ends of the rod may need to be adjusted.
16. Tighten the lock nut against the swivel(s).
17. Plug the holes after the proper CFM has been established.

Table 4-5
F/A Damper Travel Adjustment

Position of Connecting Rod (See Figure 4-5)	Damper Crank Arm Hole Configuration
Position #1	2 - 3
Position #2	2 - 4
Position #3	2 - 5
Position #4	2 - 6
Position #5	1 - 8
Position #6	1 - 7

Use the tables below to select the appropriate crank arm hole configuration based on the;

- a. specific unit,
- b. operating CFM,
- c. and return static pressure.

Note: As shipped from the factory, the connect rod is installed in Position #1.

Fresh Air Damper Pressure Drop (*inches w.c.*)

20 and 25 Ton Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
4000	0.03	0.04	0.06	0.13	0.16	0.33
6000	0.03	0.04	0.10	0.20	0.30	0.90
8000	0.19	0.21	0.32	0.52	0.75	1.75
9000	0.30	0.35	0.48	0.76	1.08	2.40
10000	0.45	0.51	0.70	1.05	1.57	-
11000	0.62	0.71	0.95	1.42	2.15	-

50 - 55 Ton Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
10000	0.03	0.04	0.09	0.18	0.23	0.55
14000	0.09	0.12	0.20	0.35	0.50	1.36
18000	0.31	0.36	0.50	0.79	1.10	-
20000	0.45	0.51	0.70	1.05	1.57	-
22000	0.58	0.66	0.75	1.30	1.95	-
24000	0.75	0.88	1.10	1.75	2.50	-

30 Ton Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
6000	0.03	0.04	0.07	0.15	0.20	0.43
8000	0.03	0.05	0.11	0.21	0.30	0.90
10000	0.15	0.19	0.26	0.43	0.62	1.50
11000	0.20	0.25	0.37	0.60	0.85	1.85
12000	0.31	0.36	0.50	0.79	1.10	2.40
13000	0.42	0.48	0.62	0.97	1.42	-

60 - 75 Ton Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
14000	0.03	0.04	0.12	0.25	0.35	1.05
18000	0.19	0.21	0.32	0.52	0.75	1.75
22000	0.45	0.51	0.70	1.05	1.57	-
26000	0.70	0.80	1.02	1.58	2.30	-
28000	0.88	1.03	1.30	2.20	-	-
30000	1.05	1.22	1.55	2.65	-	-

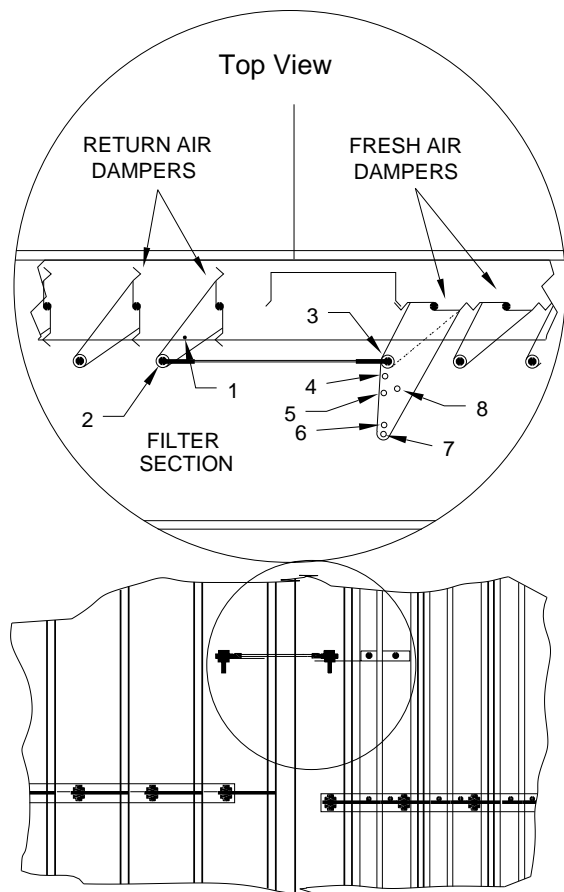
40 Ton Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
8000	0.03	0.04	0.08	0.16	0.21	0.52
10000	0.03	0.05	0.11	0.21	0.30	0.90
12000	0.10	0.13	0.21	0.38	0.55	1.40
14000	0.20	0.25	0.37	0.60	0.85	1.85
16000	0.41	0.46	0.60	0.94	1.38	-
18000	0.56	0.65	0.74	1.28	1.92	-

90 - 130 Ton Units

CFM	Damper Position					
	#1	#2	#3	#4	#5	#6
27000	0.31	0.36	0.50	0.79	1.10	2.40
32000	0.55	0.64	0.72	1.25	1.88	-
36000	0.75	0.88	1.10	1.75	2.50	-
40000	1.00	1.18	1.50	2.50	-	-
43000	1.20	1.42	1.92	-	-	-
46000	1.40	1.58	2.29	-	-	-

Figure 4-5
Fresh Air & Return Air Linkage Adjustment



Compressor Start-Up (All Systems)

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position.
2. Before closing the disconnect switch, ensure that the compressor discharge service valve and the liquid line service valve for each circuit is back seated.

CAUTION Compressor Damage!

Do not allow liquid refrigerant to enter the suction line. Excessive liquid accumulation in the liquid lines may result in compressor damage.

COMPRESSOR SERVICE VALVES MUST BE FULLY OPENED BEFORE START-UP (SUCTION, DISCHARGE, LIQUID LINE, AND OIL LINE).

3. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14 to allow the crankcase heater to operate a minimum of 8 hours before continuing.

Note: Compressor Damage could occur if the crankcase heater is not allowed to operate the minimum of 8 hours before starting the compressor(s).

4. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
5. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the RT-SVP01A-EN for CV applications or RT-SVP02A-EN for VAV applications for the SERVICE TEST screens and programming instructions.
6. Use Table 4-1 to program the following system components for operation by scrolling through the displays;

20 to 30 Ton

Compressor 1A (On)
Compressor 1B (Off)
Condenser Fans

40 through 60 Ton

Compressor 1A (On)
Compressor 1B (Off)
Compressor 2A (Off)
Compressor 2B (Off)
Condenser Fans

70 & 105 Ton

Compressor 1A & 1B (On)
Compressor 1C (Off)
Compressor 2A & 2B (Off)
Compressor 2C (Off)
Condenser Fans

115 & 130 Ton

Compressor 1A & 1B (On)
Compressor 1C & 1D (Off)
Compressor 2A & 2B (Off)
Compressor 2C & 2D (Off)
Condenser Fans

7. Attach a set of service gauges onto the suction and discharge gauge ports for each circuit. Refer to Figure 4-6 for the various compressor locations.
8. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in __Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.

WARNING Rotating Components!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

9. Press the TEST START key to start the test. Remember that the delay designated in step 8 must elapse before the system will begin to operate.
10. Once each compressor or compressor pair has started, verify that the rotation is correct. If a scroll compressor is rotating backwards, it will not pump and a loud rattling sound can be observed. Check the electrical phasing at the load side of the compressor contactor. If the phasing is correct, before condemning the compressor, inter-

Unit Start-Up (Continued)

change any two leads to check the internal motor phasing. If the compressor runs backward for an extended period (15 to 30 minutes), the motor winding can overheat and cause the motor winding thermostats to open. This will cause a "compressor trip" diagnostic and stop the compressor.

11. Press the STOP key at the Human Interface Module in the unit control panel to stop the compressor operation.
12. Repeat steps 5 through 11 for each compressor stage and the appropriate condenser fans.

Refrigerant Charging

1. Attach a set of service gauges onto the suction and discharge gauge ports for each circuit. Refer to Figure 4-6 for the various compressor locations.
2. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the SAHF-PTG-1B for CV applications or SAHF-PTG-2B for VAV applications for the SERVICE TEST screens and programming instructions.
3. Use Table 4-1 to program the following system components for the number 1 refrigeration circuit by scrolling through the displays:
 - Supply Fan (On)
 - Inlet Guide Vanes/VFD (100%, if applicable)
 - OCC/UNOCC Relay (Unoccupied for VAV units)
 - All Compressors for each circuit (On)
 - Condenser Fans for each circuit (On)
4. Once the configuration for the components is complete, press the NEXT key until the LCD displays the "Start test in ___Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.



WARNING Rotating Components!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

5. Press the TEST START key to start the test. Remember that the delay designated in step 4 must elapse before the system will begin to operate.
6. After all of the compressors and condenser fans for the number 1 circuit have been operating for approximately 30 minutes, observe the operating pressures. Use the appropriate pressure curve in Tables 4-6 to determine the proper operating pressures. For superheat and subcooling guidelines, refer to "Thermostatic Expansion Valves and Charging by Subcooling" at the end of this section.

Note: Do Not release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all Federal, State and local laws. Refer to general service bulletin MSCU-SB-1 (latest edition).

7. Verify that the oil level in each compressor is correct. The oil level may be down to the bottom of the sightglass but should never be above the sightglass.
8. Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.
9. Repeat steps 1 through 8 for the number 2 refrigeration circuit.
10. After shutting the system off, check the compressor's oil's appearance. Discoloration of the oil indicates that an abnormal condition has occurred. If the oil is dark and smells burnt, it has overheated because of: compressor is operating at extremely high condensing temperatures; high superheat; a compressor mechanical failure; or, occurrence of a motor burnout.

If the oil is black and contains metal flakes, a mechanical failure has occurred. This symptom is often accompanied by a high compressor amperage draw.

If a motor burnout is suspected, use an acid test kit to check the condition of the oil. Test results will indicate an acid level exceeding 0.05 mg KOH/g if a burnout occurred.

The scroll compressor uses Trane OIL-42 without substitution. The appropriate oil charge for a 9 and 10 Ton scroll compressor is 8.5 pints. For a 14 and 15 Ton scroll compressor, use 13.8 pints.

Compressor Crankcase Heaters

9 and 10 ton scroll compressors have a 100-watt heater installed. 14 and 15 ton scroll compressors have two 80-watt heaters installed per compressor.

Compressor Operational Sounds

Because of the scroll compressor design, it emits a higher frequency tone (sound) than a reciprocating compressor. It is designed to accommodate liquids, both oil and refrigerant, without causing compressor damage. The following discussion describes some of the operational sounds that differentiate it from those typically associated with a reciprocating compressor. These sounds do not affect the operation or reliability of the compressor.

At Shutdown

When a Scroll compressor shuts down, the gas within the scroll expands and causes momentary reverse rotation until the discharge check valve closes. This results in a "flutter" type sound.

At Low Ambient Start-Up

When the compressor starts up under low ambient conditions, the initial flow rate of the compressor is low due to the low condensing pressure. This causes a low differential across the thermal expansion valve that limits its capacity. Under these conditions, it is not unusual to hear the compressor rattle until the suction pressure climbs and the flow rate increases.

Figure 4-6
Compressor Locations

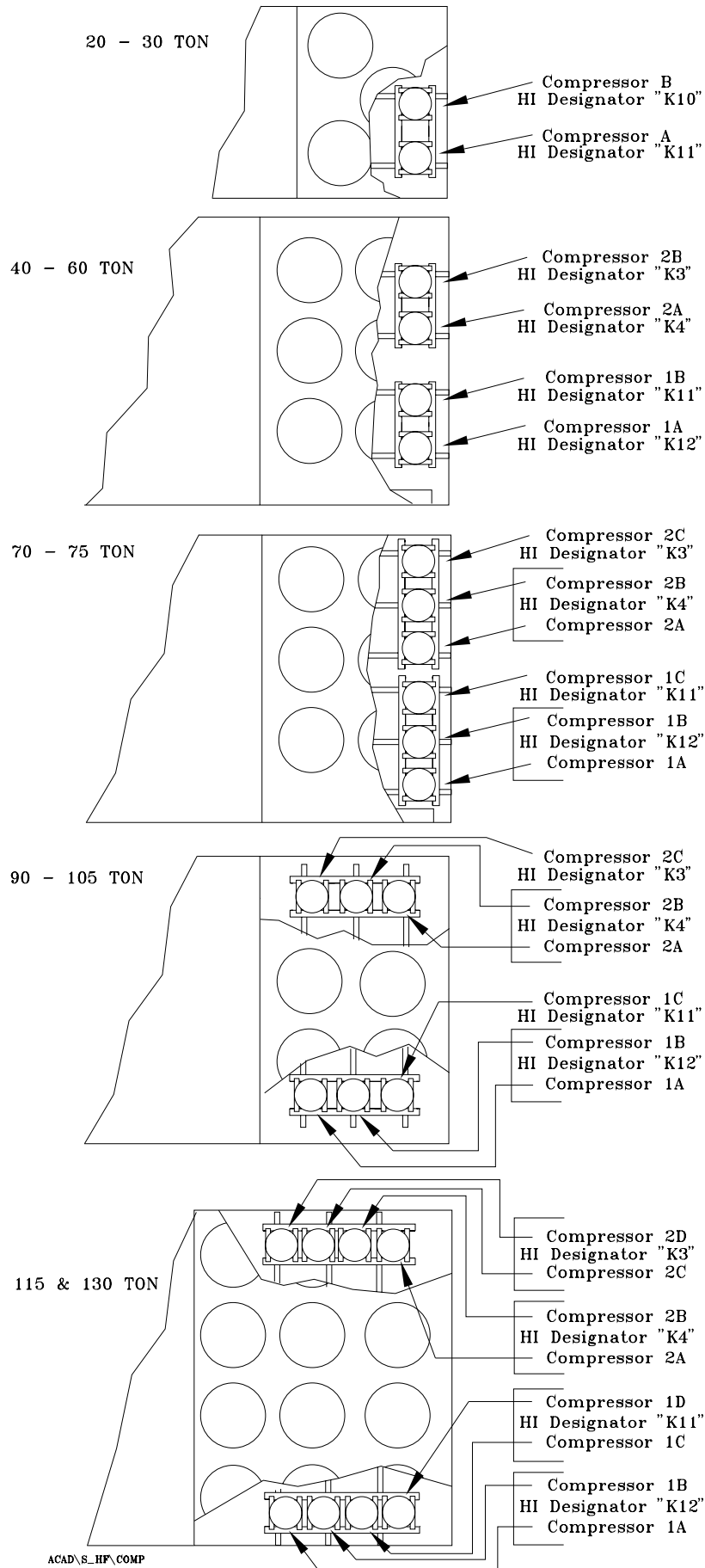
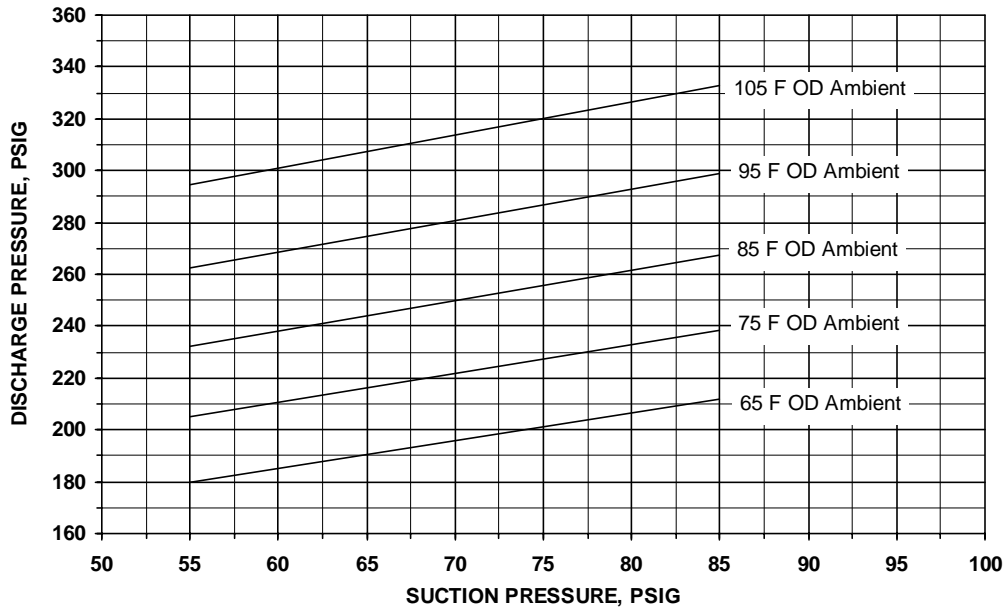


Table 4-6

20 Ton Operating Pressure Curve (All Compressors and Condenser Fans "On")

COOLING CYCLE PRESSURE CURVE
 (Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD

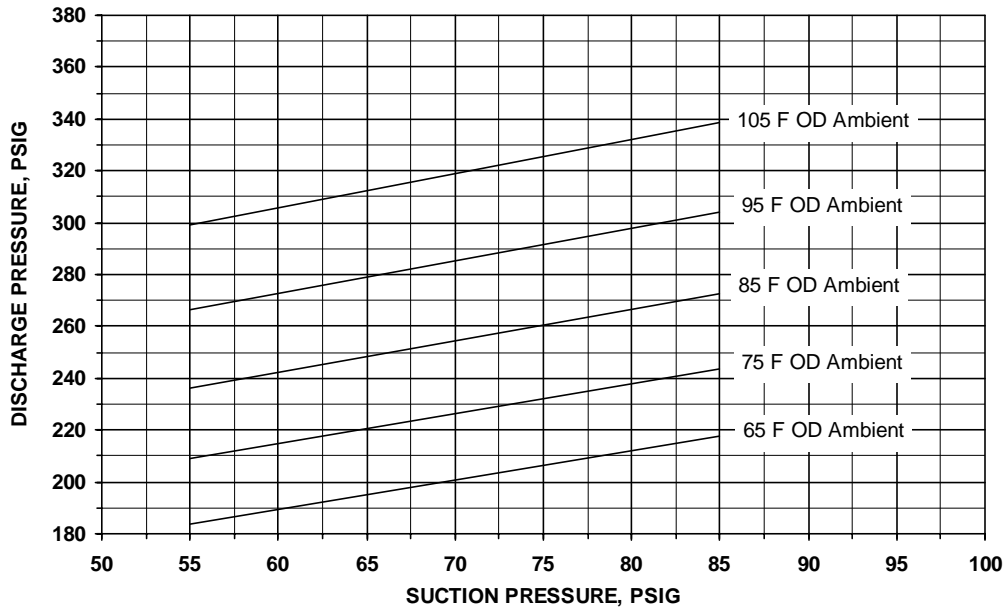


To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

25 Ton Operating Pressure Curve (All Compressors and Condenser Fans "On")

COOLING CYCLE PRESSURE CURVE
 (Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD



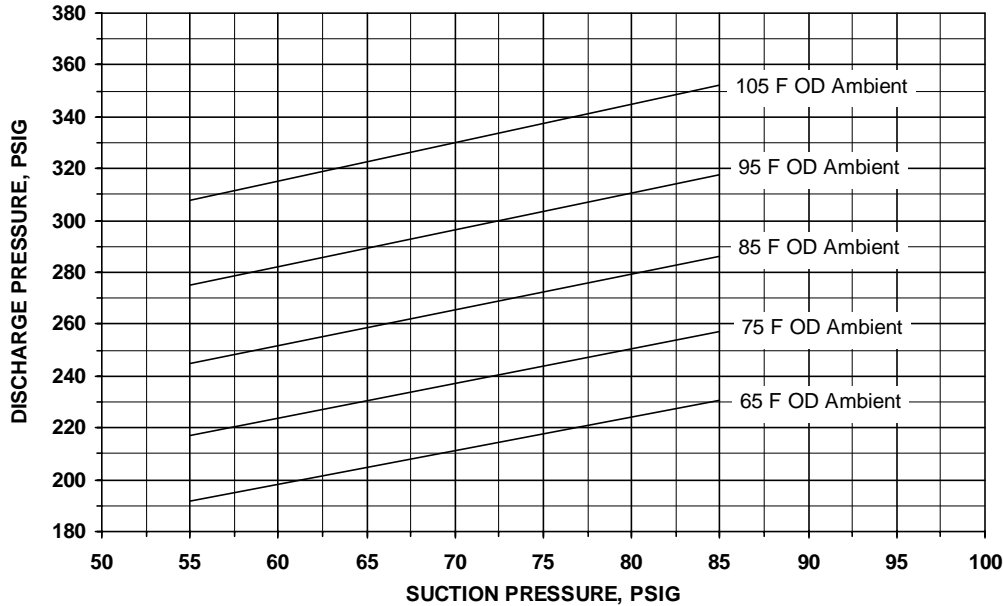
To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

Table 4-6 (Continued)

30 Ton Operating Pressure Curve (All Compressors and Condenser Fans "On")

COOLING CYCLE PRESSURE CURVE
 (Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD

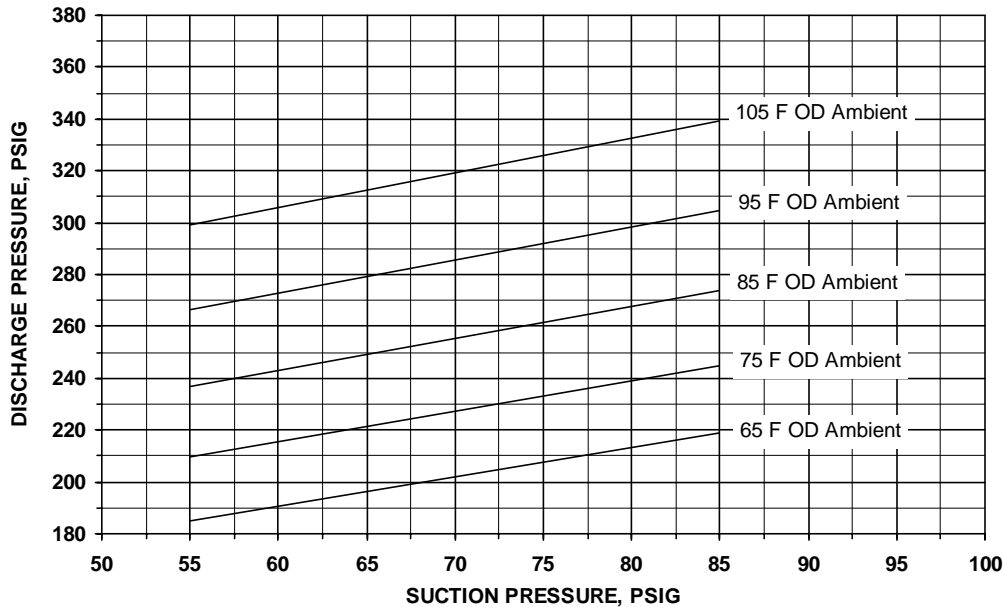


To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

40 Ton Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

COOLING CYCLE PRESSURE CURVE
 (Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD



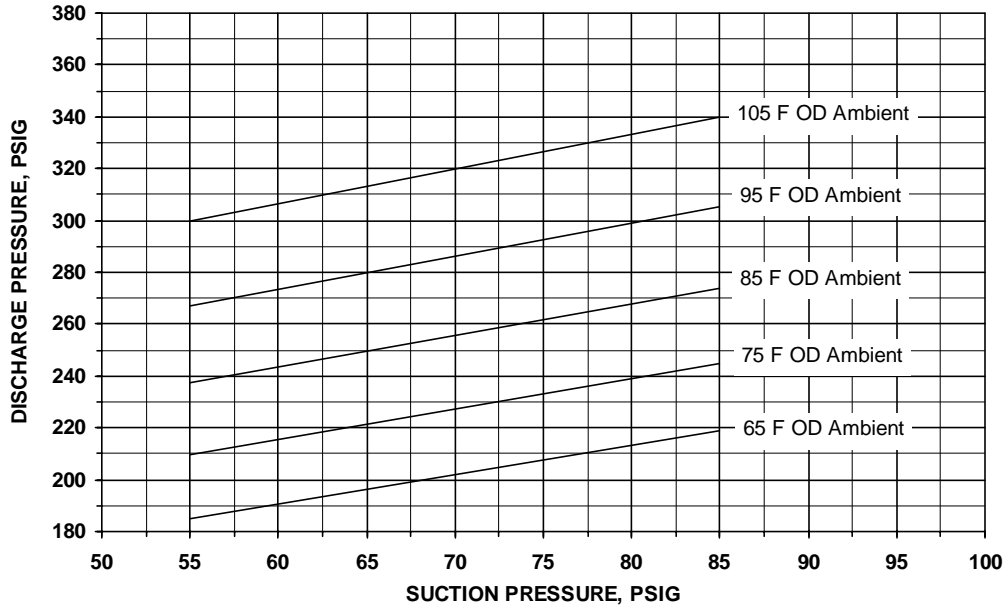
To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

Table 4-6 (Continued)

50 Ton Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

COOLING CYCLE PRESSURE CURVE
 (Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD



To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

55 Ton Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

55 Ton Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

Cooling Cycle Pressure Curve
 (Based on Indoor Airflow of 400 CFM / Ton)
Full Load

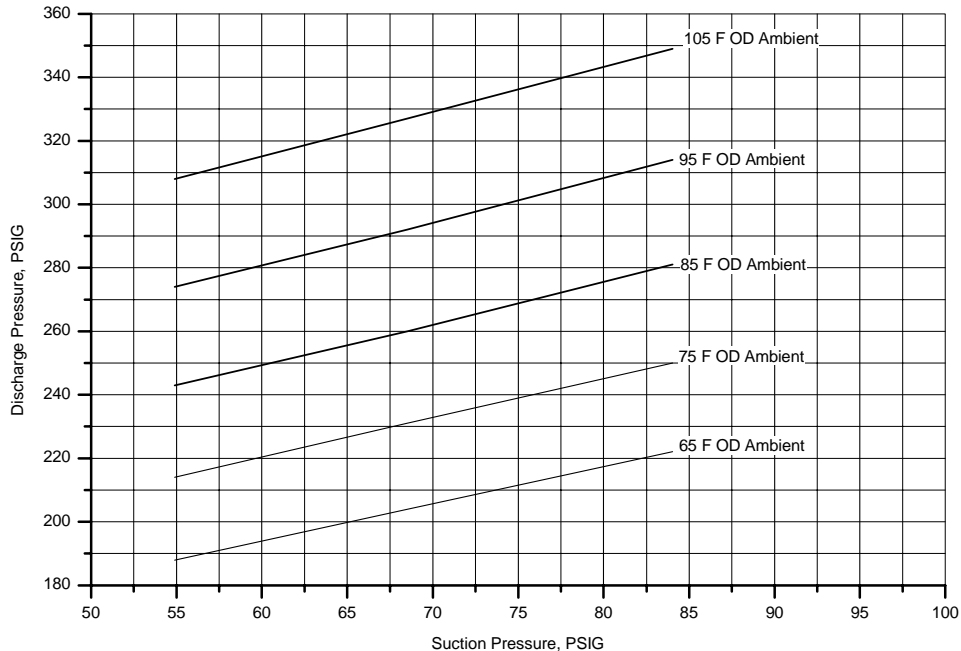
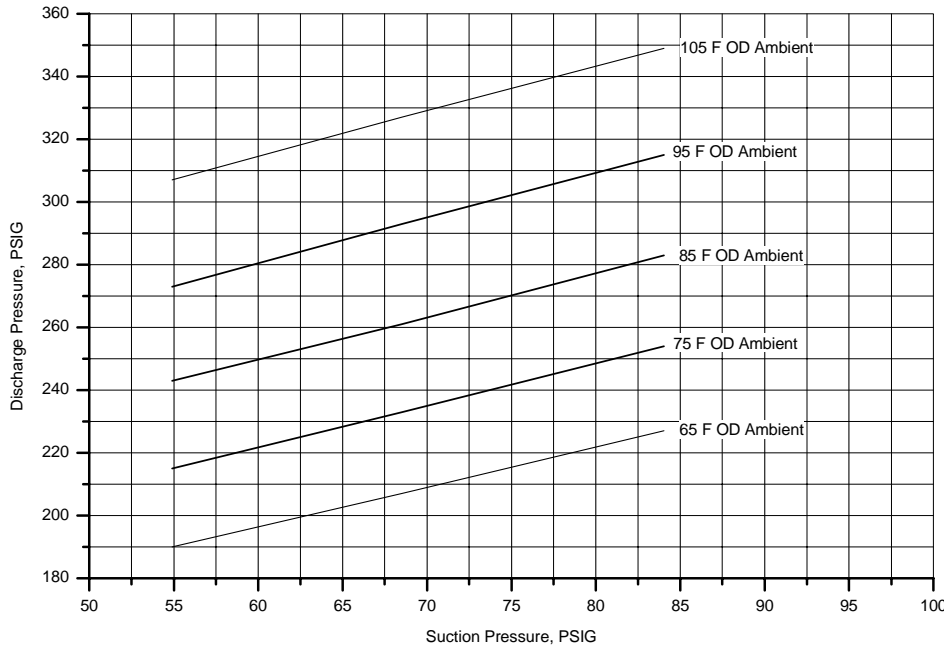


Table 4-6 (Continued)

55 Ton Hi Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

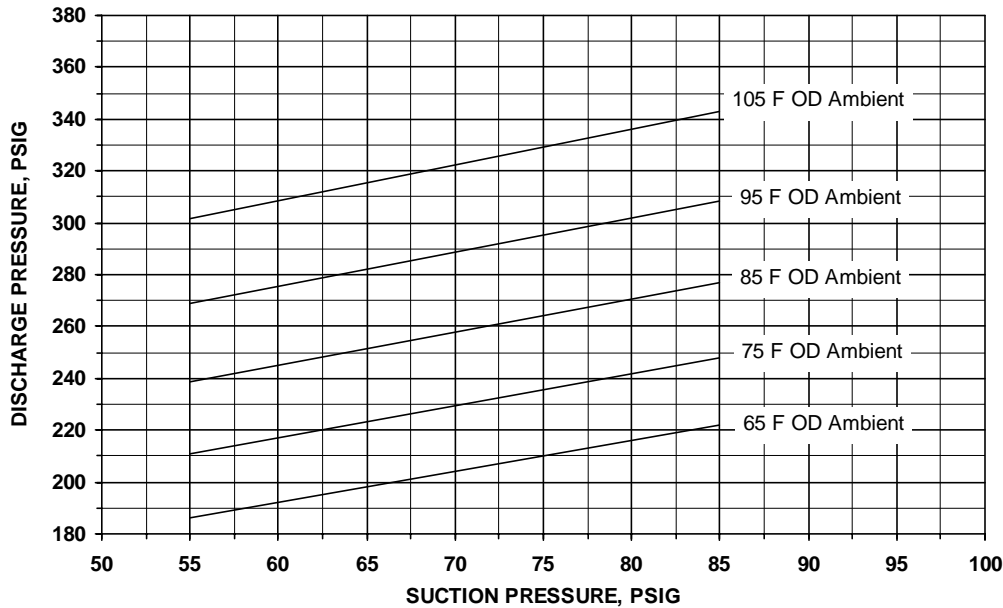
55 Ton Hi Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

Cooling Cycle Pressure Curve
(Based on Indoor Airflow of 400 CFM / Ton)
Full Load



60 Ton Operating Pressure Curve (All Compressors and Condenser Fans, per ckt; "On")

COOLING CYCLE PRESSURE CURVE
(Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD



To Check Operating Pressures

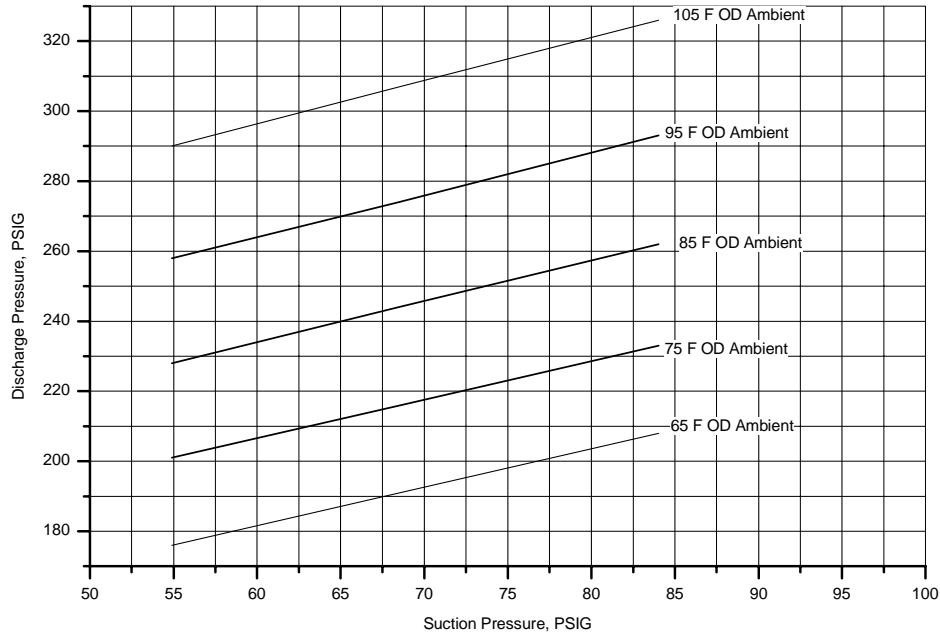
1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

Table 4-6 (Continued)

60 Ton Hi Operating Pressure Curve (All Compressors and Condenser Fans, per ckt; "On")

60 Ton Hi Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

Cooling Cycle Pressure Curve
 (Based on Indoor Airflow of 400 CFM / Ton)
 Full Load



70 Ton Standard Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

70 Ton Standard Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

Cooling Cycle Pressure Curve
 (Based on Indoor Airflow of 400 CFM / Ton)
 Full Load

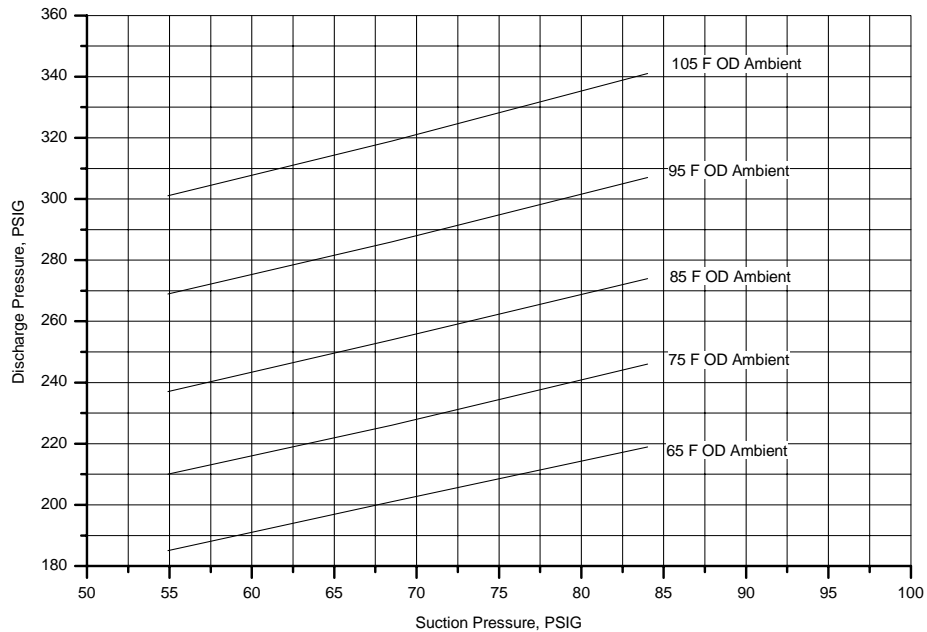
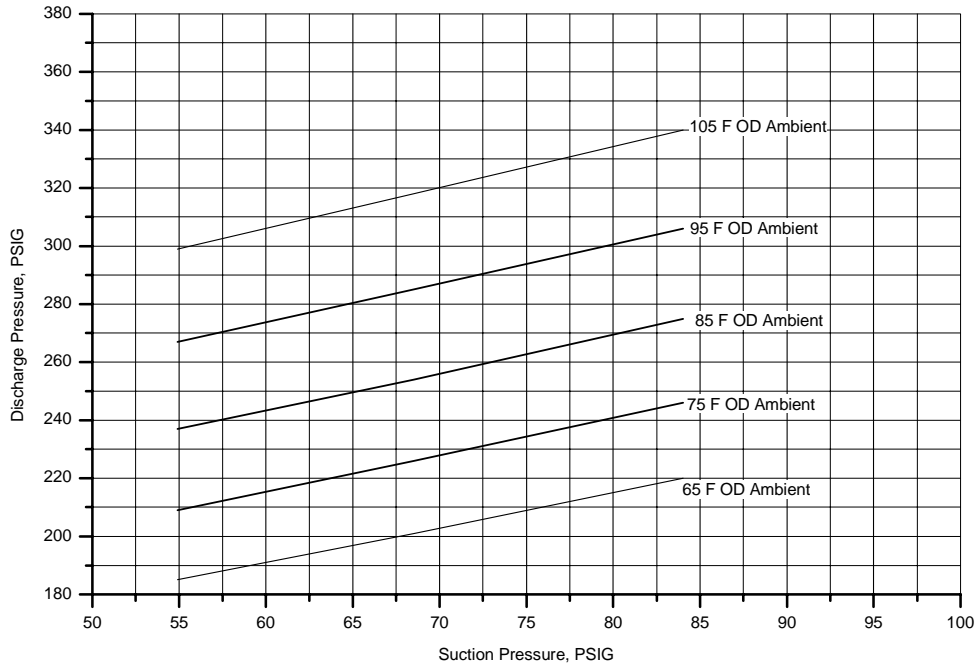


Table 4-6 (Continued)

75 Ton Standard Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

75 Ton Std Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

Cooling Cycle Pressure Curve
 (Based on Indoor Airflow of 400 CFM / Ton)
 Full Load



75 Ton Hi-Cap Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

75 Ton Hi-Cap Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

Cooling Cycle Pressure Curve
 (Based on Indoor Airflow of 400 CFM / Ton)
 Full Load

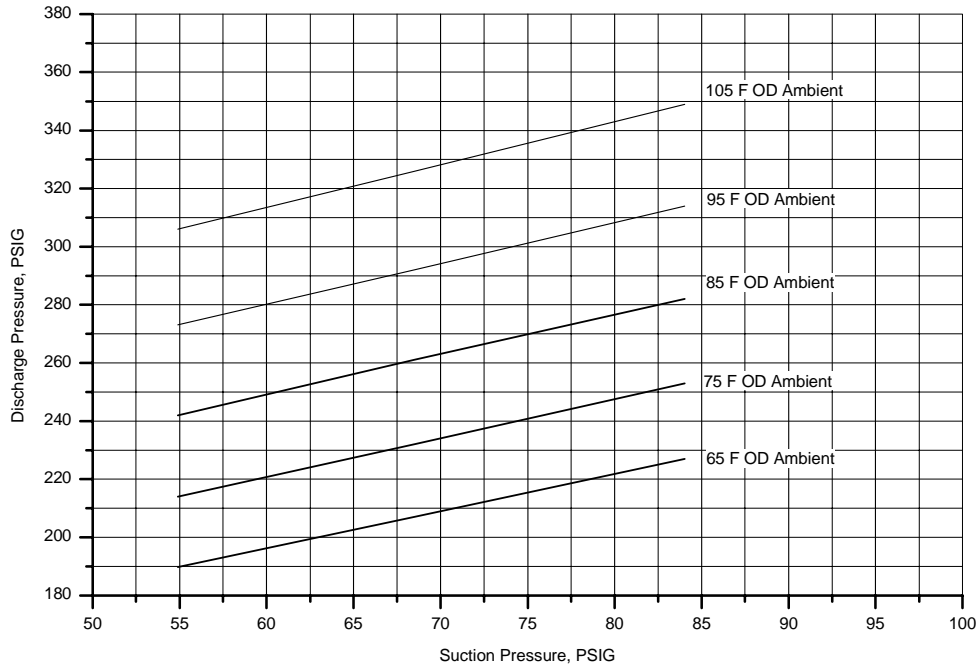
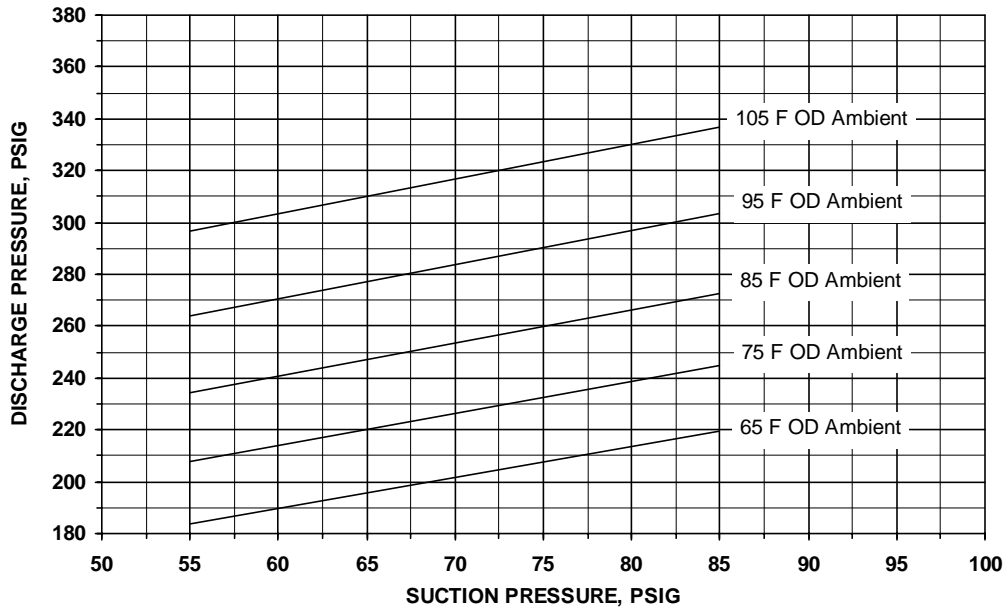


Table 4-6 (Continued)

90 Ton Operating Pressure Curve (All Compressors and Condenser Fans, per ckt; "On")

COOLING CYCLE PRESSURE CURVE
 (Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD

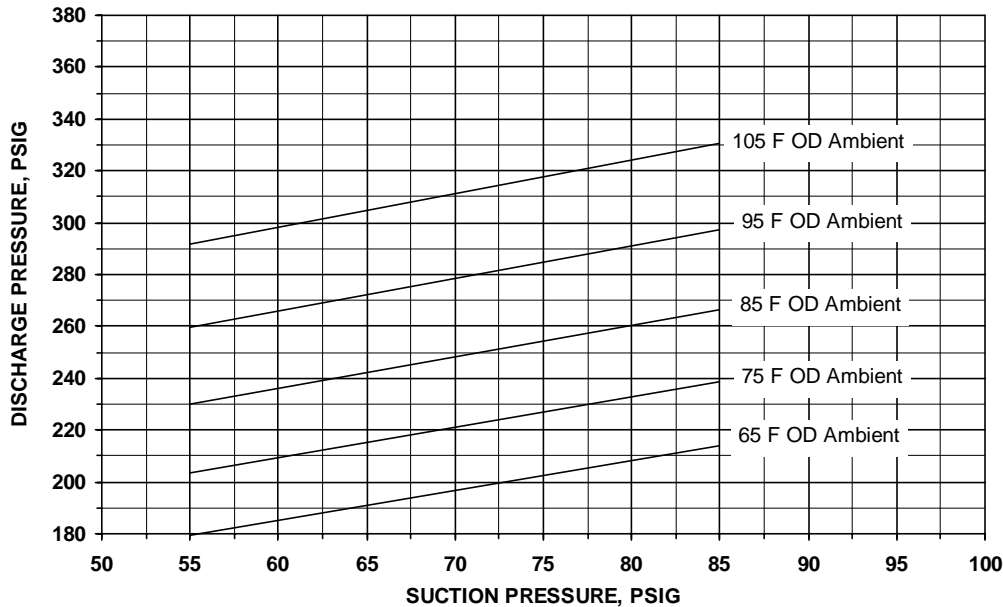


To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

105 Ton Standard & Hi-Cap Operating Pressure Curve (All Compressors and Condenser Fans, per ckt, "On")

COOLING CYCLE PRESSURE CURVE
 (Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD



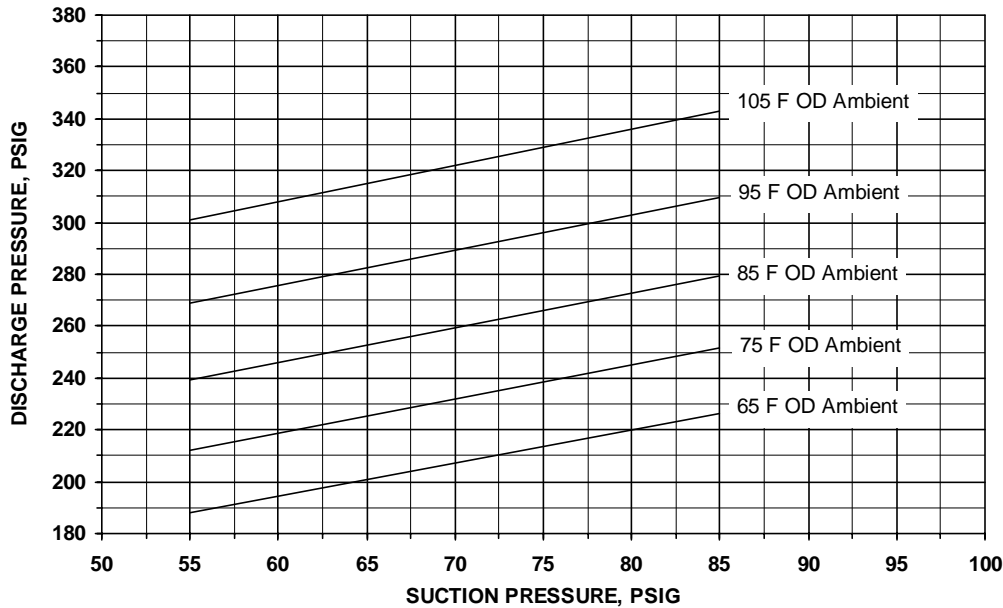
To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

Table 4-6 (Continued)

115 Ton Operating Pressure Curve (All Compressors and Condenser Fans, per ckt; "On")

COOLING CYCLE PRESSURE CURVE
 (Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD

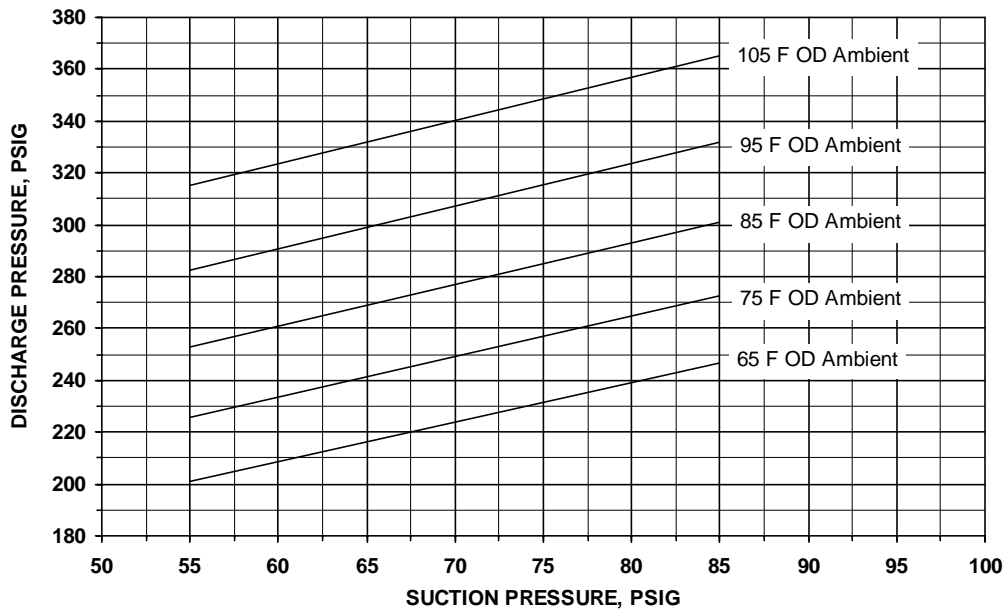


To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

130 Ton Operating Pressure Curve (All Compressors and Condenser Fans, per ckt; "On")

COOLING CYCLE PRESSURE CURVE
 (Based on Indoor Airflow of 400 CFM / Ton)
FULL LOAD



To Check Operating Pressures

1. Start the unit and allow the pressures to stabilize.
2. Measure the outdoor air dry bulb temperature (F) entering the condenser coil.
3. Measure the discharge and suction pressure (psig) next to the compressor.
4. Plot the outdoor dry bulb temperature and the operating suction pressure (psig) onto the chart.
5. At the point of intersection, read to the left for the discharge pressure. The measured discharge pressure should be within ± 7 psig of the graph.

Thermostatic Expansion Valves

The reliability and performance of the refrigeration system is heavily dependent upon proper expansion valve adjustment. Therefore, the importance of maintaining the proper superheat cannot be over emphasized. Accurate measurements of superheat will provide the following information.

1. How well the expansion valve is controlling the refrigerant flow.
2. The efficiency of the evaporator coil.
3. The amount of protection the compressor is receiving against flooding or overheating. The recommended range for superheat is 10 to 16 degrees at the evaporator. Systems operating with less than 10 degrees of superheat:
 - a. Could cause serious compressor damage due to refrigerant floodback.
 - b. Removes working surface from the evaporator normally used for heat transfer.

Systems operating with superheat in excess of 16 degrees:

- a. Could cause excessive compressor cycling on internal winding thermostat which leads to compressor motor failure.
- b. Lowers the efficiency of the evaporator by reducing the heat transfer capability.

Tables are based on outdoor ambient between 65 & 105 F, relative humidity above 40 percent. Measuring the operating pressures can be meaningless outside of these ranges.

Measuring Superheat

1. Measure the suction pressure at the suction line gauge access port located near the compressor.
2. Using a Refrigerant/Temperature chart, convert the pressure reading to a corresponding saturated vapor temperature.
3. Measure the suction line temperature as close to the expansion valve bulb, as possible.
4. Subtract the saturated vapor temperature obtained in step 2 from the actual suction line temperature obtained in step 3. The difference between the two temperatures is known as "superheat".

When adjusting superheat, recheck the system subcooling before shutting the system "Off".

Charging by Subcooling

The outdoor ambient temperature must be between 65 and 105 F and the relative humidity of the air entering the evaporator must be above 40 percent. When the temperatures are outside of these ranges, measuring the operating pressures can be meaningless.

Do not attempt to charge the system with the low ambient dampers and/or hot gas bypass operating (if applicable). Disable the low ambient dampers in the "Open" position (refer to the "Low Ambient Damper" section) and de-energize the hot gas bypass valves before taking performance measurements.

Unit Start-Up (Continued)

With the unit operating at "Full Circuit Capacity", acceptable subcooling ranges between 14 F to 22 F.

Measuring Subcooling

1. At the liquid line service valve, measure the liquid line pressure. Using a Refrigerant 22 pressure/temperature chart, convert the pressure reading into the corresponding saturated temperature.
2. Measure the actual liquid line temperature as close to the liquid line service valve as possible. To ensure an accurate reading, clean the line thoroughly where the temperature sensor will be attached. After securing the sensor to the line, insulate the sensor and line to isolate it from the ambient air.

Note: Glass thermometers do not have sufficient contact area to give an accurate reading.

3. Determine the system subcooling by subtracting the actual liquid line temperature (measured in step 2) from the saturated liquid temperature (converted in step 1).

Low Ambient Dampers

Operation

Low Ambient Dampers are available as a factory installed option on 20 - 75 Ton units or can be field-installed. Dampers are used to extend the operation of these units from the standard operational temperatures to a minimum of 0F without hot gas bypass or 10F with hot gas bypass. (These values apply when wind speed across the condenser coil is less than 5 m.p.h. If typical wind speeds are higher than 5 m.p.h., a wind screen around the unit may be required.) By restricting the airflow across the condenser coils, saturated condensing temperatures can be maintained as the ambient temperatures change.

The low ambient modulating output(s) on the compressor module controls the low ambient damper actuator for each refrigerant circuit in response to saturated condensing temperature.

When the control has staged up to its highest stage (stage 2 or 3 depending on unit size), the modulating output will be at 100% (10 VDC). When the control is at stage 1, the modulating output (0 to 10 VDC) will control the saturated condensing temperature to within the programmable "condensing temperature low ambient control point".

The following Table gives the minimum starting temperatures for both "Standard" & "Low" Ambient units. Do not start the unit in the cooling mode if the ambient temperature is below the recommended operating temperatures.

Unit Size	Minimum Starting Ambient (1)		
	Standard (2)	Low Ambient	
		with HGBP	without HGBP
20 & 40	55°	10°	0°
25 & 30	50°	10°	0°
70 - 130	45°	10°	0°
55	40°	10°	0°
50	35°	10°	0°
60	30°	10°	0°

Notes:

1. Min. starting ambients in degrees F and is based on unit operating at min. step of unloading & unloading & 5 mph wind across condenser.
2. With or Without HGBP

Damper Installation

When a unit is ordered with the low ambient option (i.e., Digit 19 is a "1" in the model number), a damper is factory installed over the condenser fans 2B1, 2B4, 2B13 & 2B14 (depending on unit size). Refer to the illustration in Figure 4-1 for the damper locations.

For field installation, mount the dampers over the condenser fans at the locations shown in Figure 4-1 and connect the actuator for each circuit. (Refer to the Installation Instructions provided with each kit.)

Damper Adjustment (Factory or Field Installed)

The UCM has a factory default setpoint of 90F. This setpoint can be adjusted using the Human Interface programming procedures.

Inspect the damper blades for proper alignment and operation. Dampers should be in the closed position during the "Off" cycle. If adjustment is required;

1. At the Human Interface, program the actuator for 0% on circuit #1 and/or circuit #2. (The output signal will go to 0.0 VDC.)
2. Loosen the damper shaft "Locking" set screws on the actuator
3. Firmly hold the damper blades in the closed position
4. Retighten the "Locking" set screws.

To check damper operation, program the actuator for 100% on circuit #1 and/or circuit #2. (The output signal will go to 10 VDC and the damper will drive to the full open position.)

Electric, Steam and Hot Water Start-Up (Constant Volume & Variable Air Volume Systems)

1. Ensure that the "System" selection switch at the remote panel is in the "Off" position.
2. Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.



WARNING **Hazardous Voltage!**

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14.

3. Turn the 115 volt control circuit switch 1S1 and the 24 volt control circuit switch 1S70 to the "On" position.
4. Open the Human Interface access door, located in the unit control panel, and press the SERVICE MODE key to display the first service screen. Refer to the latest edition of the appropriate SAHF-PTG manual for CV or VAV applications for the SERVICE TEST screens and programming instructions.

Unit Start-Up (Continued)

5. Use Table 4-1 to program the following system components for operation by scrolling through the Human Interface displays;

Electric Heat

Supply Fan (On)
Inlet Guide Vanes (100% Open, if applicable)
Variable Frequency Drive (100% Output, if applicable)
RTM Occ/Unocc Output (Unoccupied)
Heat Stages 1 & 2 (On)

Steam or Hot Water Heat

Supply Fan (On)
Inlet Guide Vanes (100% Open, if applicable)
Variable Frequency Drive (100% Output, if applicable)
RTM Occ/Unocc Output (Unoccupied)
Hydronic Heat Actuator (100% Open)
Open the main steam or hot water valve supplying the rooftop heater coils.

6. Once the configuration for the appropriate heating system is complete, press the NEXT key until the LCD displays the "Start test in __Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.



WARNING **Rotating Components!**

During installation, testing, servicing and troubleshooting of this product it may be necessary to measure the speed of rotating components. Have a qualified or licensed service individual who has been properly trained in handling exposed rotating components, perform these tasks. Failure to follow all safety precautions when exposed to rotating components could result in death or serious injury.

7. Press the TEST START key to start the test. Remember that the delay designated in step 6 must elapse before the fan will begin to operate.
8. Once the system has started, verify that the electric heat or the hydronic heat system is operating properly by using appropriate service technics; i.e. amperage readings, delta tees, etc..
9. Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.

Gas Furnace Start-Up (Constant Volume & Variable Air Volume Systems)

It is important to establish and maintain the appropriate air/fuel mixture to assure that the gas furnace operates safely and efficiently.

Since the proper manifold gas pressure for a particular installation will vary due to the specific BTU content of the local gas supply, adjust the burner based on carbon dioxide and oxygen levels.

Unit Start-Up (Continued)

The volume of air supplied by the combustion blower determines the amount of oxygen available for combustion, while the manifold gas pressure establishes fuel input. By measuring the percentage of carbon dioxide produced as a by-product of combustion, the operator can estimate the amount of oxygen used and modify the air volume or the gas pressure to obtain the proper air/fuel ratio.

Arriving at the correct air/fuel mixture for a furnace results in rated burner output, limited production of carbon monoxide, and a steady flame that minimizes nuisance shutdowns.



WARNING **Hazardous Gases and Flammable Vapors!**

Exposure to hazardous gases from fuel substances have been shown to cause cancer, birth defects or other reproductive harm. Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures. To avoid hazardous gases and flammable vapors follow proper installation and set up of this product and all warnings as provided in this manual. Failure to follow all instructions could result in death or serious injury.

When using dry nitrogen cylinders for pressurizing units for leak testing, always provide a pressure regulator on the cylinder to prevent excessively high unit pressures. Never pressurize unit above the maximum recommended unit test pressure as specified in applicable unit literature. Failure to properly regulate pressure could result in a violent explosion, which could result in death or serious injury or equipment or property-only-damage.

Two Stage Gas Furnace

High-Fire Adjustment

1. Use Table 4-1 to program the following system components for operation by scrolling through the Human Interface displays;

Gas Heat

Supply Fan (On)
Inlet Guide Vanes (100% Open, if applicable)
Variable Frequency Drive (100% Output, if applicable)
RTM Occ/Unocc Output (Unoccupied)
Heat Stages 1 & 2 (On)
Turn the 115 volt control circuit switch 4S24 located in the heater control panel to the "On" position.
Open the manual gas valve, located in the gas heat section.

2. Once the configuration for the appropriate heating system is complete, press the NEXT key until the LCD displays the "Start test in __Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.
3. Press the TEST START key to start the test. Remember that the delay designated in step 2 must elapse before the system will begin to operate.
4. Once the system has started, check the appearance of the flame through the sight glass provided on the front of

the heat exchanger. In appearance, a normal flame has a clearly defined shape, and is primarily (75%) blue in color with an orange tip.

5. Check the manifold gas pressure by using the manifold pressure port on the gas valve. Refer to Table 4-7 for the required manifold pressure for high-fire operation. If it needs adjusting, remove the cap covering the high-fire adjustment screw on the gas valve. Refer to Figure 4-8 for the adjustment screw location. Turn the screw clockwise to increase the gas pressure or counterclockwise to decrease the gas pressure.
6. Use a carbon dioxide analyzer and measure the percentage of carbon dioxide in the flue gas. Refer to the illustration in Figure 4-7. Take several samples to assure that an accurate reading is obtained. Refer to Table 4-7 for the proper carbon dioxide levels. A carbon dioxide level exceeding the listed range indicates incomplete combustion due to inadequate air or excessive gas.

Combustion Air Adjustment (O₂)

7. Use an oxygen analyzer and measure the percentage of oxygen in the flue gas. Take several samples to assure an accurate reading. Compare the measured oxygen level to the combustion curve in Table 4-8. The oxygen content of the flue gas should be 4% to 5%. If the oxygen level is outside this range, adjust the combustion air damper to increase or decrease the amount of air entering the combustion chamber. Refer to Figure 4-10 for the location of the combustion air damper .
8. Recheck the oxygen and carbon dioxide levels after each adjustment. After completing the high-fire checkout and adjustment procedure, the low-fire setting may require adjusting.

Low-Fire Adjustment

(500 MBH, 850 & 1,000 MBH only)

1. Use the TEST initiation procedures outlined in the previous section to operate the furnace in the low-fire state (1st Stage).
2. Use a carbon dioxide analyzer and measure the percentage of carbon dioxide in the flue gas. Refer to the illustration in Figure 4-7, Inset A. Take several samples to assure that an accurate reading is obtained. Refer to Table 4-8 for the proper carbon dioxide levels. If the measured carbon dioxide level is within the listed values, no adjustment is necessary. A carbon dioxide level exceeding the listed range indicates incomplete combustion due to inadequate air or excessive gas.
3. Check the manifold gas pressure by using the manifold pressure port on the gas valve. Refer to Table 4-8 for the required manifold pressure during low-fire operation. If it needs adjusting, remove the cap covering the low-fire adjustment screw on the gas valve. Refer to Figure 4-8 for the adjustment screw location. Turn the screw clockwise to increase the gas pressure or counterclockwise to decrease the gas pressure.

Note: Do not adjust the combustion air damper while the furnace is operating at low-fire.

4. Check the carbon dioxide levels after each adjustment.
5. Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.

Table 4-7
Recommended Manifold Pressures and CO₂ Levels during Furnace Operation (See Notes)

Furnace Stage	MBH	Firing Rate	Manifold %CO ₂	Manifold Pressure
High-Fire	235	100%	8.5-9.5	3.0-3.5
Low-Fire	117	50%	6.0-7.0	0.9
High-Fire	350	100%	8.5-9.5	3.0-3.5
Low-Fire	175	50%	6.0-7.0	0.9
High-Fire	500	100%	8.5-9.5	3.0-3.5
Low-Fire	250	50%	6.0-7.0	1.25
High-Fire	850	100%	8.5-9.5	3.0-3.5
Low-Fire	500	59%	6.0-7.0	1.25
High-Fire	1000	100%	8.5-9.5	3.0-3.5
Low-Fire	500	50%	6.0-7.0	1.25

Manifold pressures are given in inches w.c.
 High fire manifold pressure is adjustable on all heaters.
 Low fire manifold pressure is non-adjustable on 235 MBH and 350 MBH heaters.

Figure 4-7
Flue Gas Carbon Dioxide & Oxygen Measurements

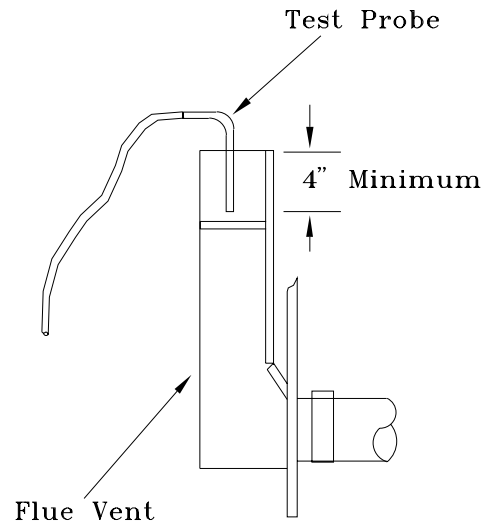


Table 4-8
Natural Gas Combustion Curve
(Ratio of Oxygen to Carbon Dioxide in percent)

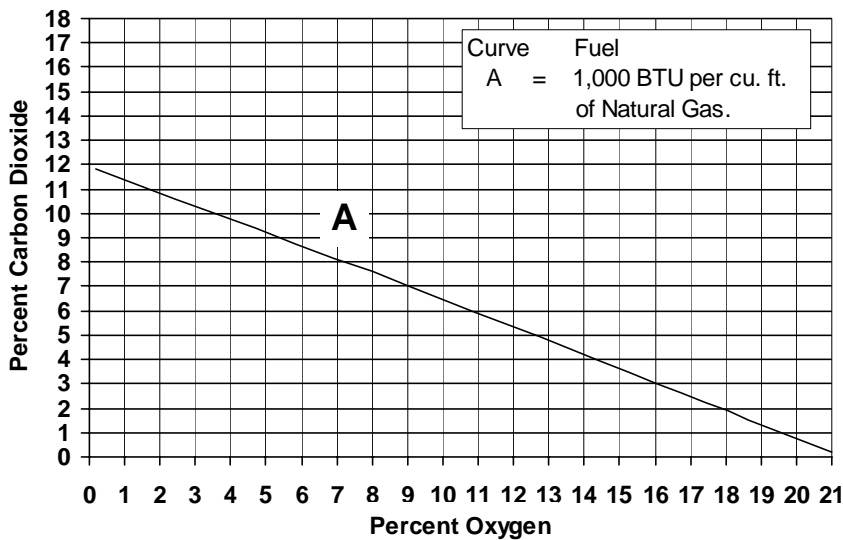
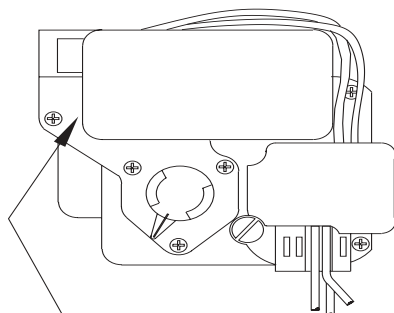


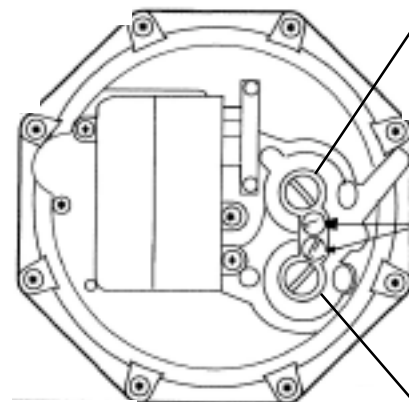
Figure 4-8
Gas Valve Adjustment Screw Locations

Top View
 235/350 MBH



"High-Fire" Manifold Pressure Adjustment Screw is Located Under this Cover (Turn Clockwise to Increase) (Turn Counterclockwise to Decrease)

Top View
 500/850/1000 MBH



"High-Fire" Manifold Pressure Adjustment Screw (Turn Clockwise to Increase) (Turn Counterclockwise to Decrease)

"Low-Fire" Manifold Pressure Adjustment Screw (Turn Clockwise to Increase) (Turn Counterclockwise to Decrease)

Full Modulating Gas Furnace

Full Modulating gas heaters are available for the 500, 850 and 1000 MBH heater sizes. These heaters are available in the same cabinet sizes as the current heaters.

The firing rate of the unit can vary from the pilot rate of 125 MBH up to the nameplate rating of the unit. The turn down ratios, therefore, vary from 4:1 for the 500 MBH to 8:1 for the 1000 MBH heater.

Heat Exchanger

The heat exchanger drum, tubes and front and rear headers are constructed from AL-6XN or 25-6MO, two of the most corrosion resistant stainless steel alloys available.

Unit control

The unit is controlled by a supply air temperature sensor located in the supply air stream for VAV units. CV units have two sensors, one located in the supply air stream and the zone sensor. The temperature sensor signal is sent to the Heat module of the Intellipak® Unit Control. The control signal from the Heat Module is an inverse proportional 5 -10V DC. The higher the voltage signal, the lower the call for heat.

The 5 -10V DC. signal controls the angular position of the combustion air damper through a direct coupled damper actuator motor. The position of the air damper in turn controls the combustion air pressure that is sensed by the modulating gas valve. The greater the combustion air pressure, the greater the call for gas and the higher the firing rate of the heater. As the temperature setpoint is reached, the Modulating Heat control will cause the combustion air actuator to change the damper position to a lower firing rate that matches the heat load of the space.

1. Use Table 4-1 to program the following system components for operation by scrolling through the Human Interface displays;

Gas Heat

Supply Fan (On)
Inlet Guide Vanes (100% Open, if applicable)
Variable Frequency Drive (100% Output, if applicable)
RTM Occ/Unocc Output (Unoccupied)
High Fire (90%)
Turn the 115 volt control circuit switch 4S24 located in the heater control panel to the "On" position.
Open the manual gas valve, located in the gas heat section.

2. Once the configuration for the appropriate heating system is complete, press the NEXT key until the LCD displays the "Start test in __Sec." screen. Press the + key to designate the delay before the test is to start. This service test will begin after the TEST START key is pressed and the delay designated in this step has elapsed. Press the ENTER key to confirm this choice.
3. Press the TEST START key to start the test. Remember that the delay designated in step 2 must elapse before the system will begin to operate.



WARNING Rotating Components!

During installation, testing, servicing and troubleshooting of this product it may be necessary to measure the speed of rotating components. Have a qualified or licensed service individual who has been properly trained in handling exposed rotating components, perform these tasks. Failure to follow all safety precautions when exposed to rotating components could result in death or serious injury.

4. Once the system has started, check the appearance of the flame through the sight glass provided on the front of the heat exchanger. In appearance, a normal flame has a clearly defined shape, and is primarily (75%) blue in color with an orange tip.
5. Check the inlet gas pressure at the modulating gas valve. The inlet pressure should be 6" to 8" w.c..
6. Use a carbon dioxide analyzer and measure the percentage of carbon dioxide in the flue gas. Refer to the illustration in Figure 4-7. Take several samples to assure that an accurate reading is obtained. If the measured carbon dioxide level is between 8.0% and 9.5%, no adjustment is necessary. If the CO₂ is outside this range, it indicates incomplete combustion due to inadequate air or excessive gas.

The pressure ratio and bias adjustment screws are located on top of the regulator under a sealed plate. The actual settings can be seen through windows on each side of the regulator. Refer to the illustration in Figure 4-9.

Note: The burner capacity is controlled by the movement of the air damper. This has been preset at the factory and normally does not need field adjustment. The combustion quality (air/gas) is controlled by the settings on the regulator (the plus (+) and minus (-) indications relate to the change in gas flow.

7. Set the air/gas ratio to the desired value using the #1 adjustment screw until the optimum values between (8.0 and 9.5%) are obtained (course setting).
8. Use Table 4-1 to program the minimum (5%) firing rate. Allow the system to operate for approximately 10 minutes.
9. Use a carbon dioxide analyzer and measure the percentage of carbon dioxide in the flue gas. If the measured carbon dioxide level is between 6.0% and 8.0%, no adjustment is necessary. If an adjustment is needed, turn the #2 adjustment screw on the regulator in the Plus (+) direction to increase the CO₂ and in the Minus (-) direction to decrease the CO₂. Refer to the illustration in Figure 4-9 for the adjustment screw location.

Note: It is normal for the low fire CO₂ to be lower than the high fire.

10. If the measured carbon dioxide level is below the recommended values for low heat, return the burner to 90% fire rate and repeat steps 6 and 7, to achieve optimum combustion.
11. Program the burner for 100% operation and recheck the CO₂ or O₂ value.
12. Check the flue gas values at several intermediate output levels. If corrections are necessary;
 - Adjust the pressure ratio screw 1 at high fire operation only.
 - Adjust the bias screw 2 at low fire operation only.
13. Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.

Limited Modulating Gas Furnace

Limited Modulating gas heaters are available for the 500, 850 and 1000 MBH heater sizes. These heaters are available in the same cabinet sizes as the current heaters.

The firing rate of the unit can vary from 33% rated MBH up to the nameplate rating of the unit. The turn down ratios, therefore, is limited to 3:1.

Heat Exchanger

The heat exchanger drum, tubes and front and rear headers utilizes the same materials as the standard two stage furnace.

Unit control

The unit is controlled by a supply air temperature sensor located in the supply air stream for VAV units. CV units have two sensors, one located in the supply air stream and the zone sensor. The temperature sensor signal is sent to the Heat module of the Intellipak[®] Unit Control. The control signal from the Heat Module is an inverse proportional 5 -10V DC. The higher the voltage signal, the lower the call for heat.

The 5 -10V DC. signal controls the angular position of the combustion air damper through a direct coupled damper actuator motor. The position of the air damper in turn controls the combustion air pressure that is sensed by the modulating gas valve. The greater the combustion air pressure, the greater the call for gas and the higher the firing rate of the heater. As the temperature setpoint is reached, the Modulating Heat control will cause the combustion air actuator to change the damper position to a lower firing rate that matches the heat load of the space.

1. To verify and check system optimum combustion, use Table 4-1 to program the limited modulating heat system components for 90% operation by scrolling through the Human Interface displays.

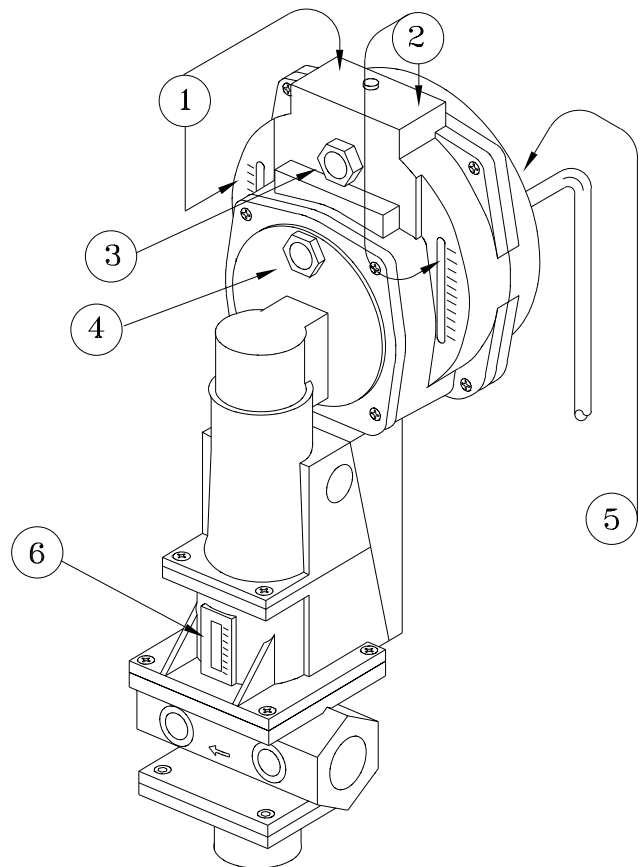
Unit Start-Up (Continued)

2. Follow the checkout procedures discussed in the previous steps.

Note: The minimum firing rate for a limited modulating gas furnace in step 8 is 33%. Travel of the combustion air damper is limited by a welded stop.

3. Press the STOP key at the Human Interface Module in the unit control panel to stop the system operation.

Figure 4-9
Modulating Gas Regulator

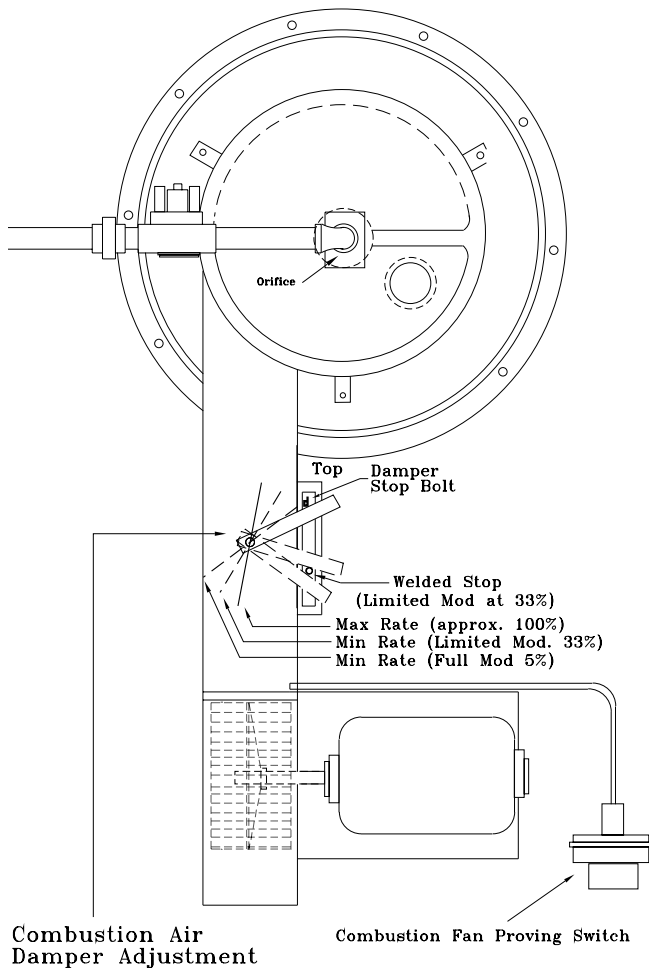


Modulating Gas Regulator Legend

1. Adjustment and indication of the air to gas ratio.
2. Adjustment and indication of the bias.
3. Connection for the Ambient compensation line.
4. Connection for the gas pressure sensing line.
5. Connection for the air pressure sensing line.
6. Stroke indication.

Note: There are no serviceable parts on the SKP70 actuator. Should it become inoperative, replace the actuator.

Figure 4-10
Typical Gas Furnace



Unit Start-Up (Continued)

Final Unit Checkout

After completing all of the checkout and start-up procedures outlined in the previous sections (i.e., operating the unit in each of its Modes through all available stages of cooling and heating), perform these final checks before leaving the unit:

- [] Close the disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block 1TB1 or the unit mounted disconnect switch 1S14.

⚠ WARNING **Hazardous Voltage!**

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14.

- [] Turn the 115 volt control circuit switch 1S1 "Off".
- [] Turn the 24 volt control circuit switch 1S70 to the "On" position.
- [] At the Human Interface Module, press the "SETUP" key. The LCD screen will display various preset "parameters of operation" based on the unit type, size, and the installed options. Compare the factory preset information to the specified application requirements. If adjustments are required, follow the step-by-step instructions provided in the appropriate SAHF-PTG manual for CV or VAV applications.
- [] Program the Night Setback (NSB) panel (if applicable) for proper unoccupied operation. Refer to the programming instructions for the specific panel.
- [] Verify that the Remote panel "System" selection switch, "Fan" selection switch, and "Zone Temperature" settings for constant volume systems are correct.
- [] Verify that the Remote panel "System" selection switch and the "Supply Air Temperature" settings for variable air volume systems are correct.
- [] Inspect the unit for misplaced tools, hardware, and debris.
- [] Turn the 115 volt control circuit switch 1S1 "On".
- [] Press the "AUTO" key at the Human Interface Module to begin system operation. The system will start automatically once the dampers modulate and a request for either heating or cooling has been given.
- [] Verify that all exterior panels including the control panel doors and condenser grilles are secured in place.

Service & Maintenance

Table 5-1
Control Settings and Time Delays

Control Description	Elec. Designation	Contacts Open	Contacts Closed
Compressor Circuit Breakers S*HF 20 - 60 S*HG 90 - 130	1CB8 thru 1CB11 1CB14 thru 1CB17	See Table 5-2 See Table 5-2	See Table 5-2 See Table 5-2
Combustion Airflow Switch (Gas Heat Only)	4S25	see note 1	0.1 - 0.25" wc rise in press diff
High Limit Cutout (Gas Heat Only)	4S26	250 + 15 F	210 F
Supply Airflow Switch (Gas Heat Only)	4S38	0.03 - 0.12" wc	0.15 + 0.05" wc rise in press diff
Disch High Limit (Electric Heat Only)	4S27	133 + 5 F	110 + 5 F
Linear High Limit (Electric Heat Only)	4S33	185 + 10 F (std./UL) 165 F + 10 F (CSA)	145 F (std./UL) 125 F (CSA)
Freezestat (Hydronic Heat Only)	4S12	(N.O.) Auto Reset	40 F
Gas Heat Units Prepurge Timer: Fenwall Honeywell	4DL5 4U18	N.C. - timed to close internal timing function	60 seconds 60 seconds
Sequencing Time Delay Relay	4DL6	N.C. - timed to close	60 seconds + 20%

Notes:

1. The combustion airflow switch (4S25) differential is 0.02" - 0.08" wc.

Table 5-2
Compressor Circuit Breakers (1CB8 - 1CB11 & 1CB14 - 1CB17) Electrical Characteristics

Unit Size	Compr. Desig.	Compr. Size	200V		230V		460V		575V	
			Must Hold	Must Trip	Must Hold	Must Trip	Must Hold	Must Trip	Must Hold	Must Trip
20	A & B	9 ton	51	58.7	51	58.7	22.2	25.5	17.7	20.4
25	B	14 ton	76	87.4	76	87.4	33	38	26.4	30.4
	A	9 ton	51	58.7	51	58.7	22.2	25.5	17.7	20.4
30	A & B	14 ton	76	87.4	76	87.4	33	38	26.4	30.4
40	1,2A & 1,2B	9 ton	51	58.7	51	58.7	22.2	25.5	17.7	20.4
50	1B, 2B	14 ton	76	87.4	76	87.4	33	38	26.4	30.4
	1A, 2A	9 ton	51	58.7	51	58.7	22.2	25.5	17.7	20.4
55	1,2A & 1,2B	14 ton	76	87.4	76	87.4	33	38	26.4	30.4
60	1,2A & 1,2B	14 ton	76	87.4	76	87.4	33	38	26.4	30.4
70	1,2C	14 ton	76	87.4	76	87.4	33	38	26.4	30.4
	1,2A & 1,2B	9 ton	51	58.7	51	58.7	22.2	25.5	17.7	20.4
75 Std.	1,2C	14 ton	76	87.4	76	87.4	33	38	26.4	30.4
	1,2A & 1,2B	9 ton	51	58.7	51	58.7	22.2	25.5	17.7	20.4
75	1,2C	15 ton	76	87.4	76	87.4	33	38	26.4	30.4
Hi-Cap	1,2A & 1,2B	10 ton	51	58.7	51	58.7	22.2	25.5	17.7	20.4
90	1,2B & 1,2C	15 ton	76	87.4	76	87.4	33	38	26.4	30.4
	1,2A	10 ton	51	58.7	51	58.7	22.2	25.5	17.7	20.4
105	1A,1B & 1C	15 ton	76	87.4	76	87.4	33	38	26.4	30.4
	2A,2B & 2C									
115	1,2C & 1,2D	15 ton	76	87.4	76	87.4	33	38	26.4	30.4
	1,2A & 1,2B	10 ton	51	58.7	51	58.7	22.2	25.5	17.7	20.4
130	1,2C & 1,2D	14 ton	76	87.4	76	87.4	33	38	26.4	30.4
	1,2A & 1,2B									

**Table 5-3
Unit Internal Fuse Replacement Data & VFD Factory Settings**

FUSE REPLACEMENT TABLE												
CONDENSER FAN FUSE 1F1 THRU 1F6 CLASS RK5	UNIT VOLTAGE	200	230	380	415	460	575					
	TIME DELAY	25A	25A	15A	15A	15A	15A					
CONTROL POWER FUSE												
CONTROL (1T1) TRANSFORMER RATING		0.25 KVA	0.30 KVA	0.50 KVA	0.75 KVA	1.00 KVA	1.50 KVA					
1F7 TYPE S	20 - 30 TON	6.25A	6.25A		10A							
	40 TON	15A	20A		20A							
	50 - 60 TON			15A		20A						
	70 - 130 TON					15A	20A					
ELECTRIC HEAT FUSE	4F19 THRU 4F36, 4F46, 47, 48				CLASS K5			60A				
COMPRESSOR PROTECTION FUSE	1F44 & 1F45				TYPE MTH			6A				
TRANSFORMER CIRCUIT FUSE	1F72 THRU 1F74				TYPE FLO			15A				
OPTIONAL EXHAUST FAN CIRCUIT FUSES												
20 THRU 130 TON 1F63-1F65 (CLASS "T" FUSES)	STANDARD MOTORS											
	UNIT VOLTAGE	FUSE RATING	1.5 HP	3 HP	5 HP	7.5 HP	10 HP	15 HP	20 HP	25 HP	30 HP	40 HP
	200V/60/3	600V	15A	35A	45A	70A	100A	150A	175A	225A	225A	400A
	230V/60/3	600V	15A	25A	45A	70A	80A	125A	150A	200A	225A	350A
	380V/50/3	600V	10A	15A	30A	50A	60A	90A	110A	125A	125A	N/A
	415V/50/3	600V	10A	15A	30A	45A	50A	90A	100A	125A	125A	N/A
	460V/60/3	600V	10A	15A	25A	35A	40A	70A	80A	100A	125A	175A
	575V/60/3	600V	10A	15A	15A	25A	30A	40A	50A	60A	60A	100A
	HIGH EFFICIENCY MOTORS											
	UNIT VOLTAGE	FUSE RATING	1.5 HP	3 HP	5 HP	7.5 HP	10 HP	15 HP	20 HP	25 HP	30 HP	40 HP
	200V/60/3	600V	N/A	40A	45A	80A	100A	125A	175A	225A	225A	350A
	230V/60/3	600V	N/A	25A	45A	60A	90A	125A	150A	175A	225A	300A
	460V/60/3	600V	N/A	15A	25A	35A	45A	60A	90A	110A	125A	150A
	575V/60/3	600V	10A	15A	15A	25A	30A	40A	50A	60A	60A	100A
OPTIONAL CONVENIENCE OUTLET FUSE 1F55 AND 1F56 (TIME DELAY TYPE FUSE)			200V/60/3	230V/60/3	380V/50/3	415V/50/3	460V/60/3	575V/60/3				
			12A	10A	N/A	N/A	5A	4A				

19 15A FUSE REPLACEMENT IS REQUIRED FOR 50 THRU 60 TON - 0.50 KVA TRANSFORMER WITH 200V - 230V - 460V OR 575V UNIT VOLTAGE.
20A FUSE REPLACEMENT IS REQUIRED FOR 50 THRU 60 TON - 0.50 KVA TRANSFORMER WITH 380V OR 415V UNIT VOLTAGE.

Table 5-4
Filter Data

Unit Model	Panel-Type Filters (Note 1)		Bag-Type Filters (Note 2)		Cartridge Filters (box-type) (Note 2)		Panel-Type Prefilters (Note 3)	
	Qty	Size of each	Qty.	Size of each	Qty.	Size of each	Qty.	Size of each
S_HF-C20 & C25	12	20 X 20 X 2	4	12 X 24 X 19	4	12 X 24 X 12	4	12 X 24 X 2
			3	24 X 24 X 19	3	24 X 24 X 12	3	24 X 24 X 2
S_HF-C30	16	20 X 20 X 2	2	12 X 24 X 19	2	12 X 24 X 12	2	12 X 24 X 2
			6	24 X 24 X 19	6	24 X 24 X 12	6	24 X 24 X 2
S_HF-C40	16	20 X 25 X 2	5	12 X 24 X 19	5	12 X 24 X 12	5	12 X 24 X 2
			6	24 X 24 X 19	6	24 X 24 X 12	6	24 X 24 X 2
S_HF-C50 & C55	20	20 X 25 X 2	3	12 X 24 X 19	3	12 X 24 X 12	3	12 X 24 X 2
			9	24 X 24 X 19	9	24 X 24 X 12	9	24 X 24 X 2
S_HF-C60, C70 & C75	35	16 X 20 X 2	6	12 X 24 X 19	6	12 X 24 X 12	6	12 X 24 X 2
			8	24 X 24 X 19	8	24 X 24 X 12	8	24 X 24 X 2
S_HG-C90 & S_HG-D11	25	24 X 24 X 2	3	12 X 24 X 19	3	12 X 24 X 12	3	20 X 24 X 2
			15	24 X 24 X 19	15	24 X 24 X 12	15	24 X 24 X 2
S_HG-D12 & S_HG-D13	25	24 X 24 X 2	3	12 X 24 X 19	3	12 X 24 X 12	3	20 X 24 X 2
			15	24 X 24 X 19	15	24 X 24 X 12	15	24 X 24 X 2

Notes:

1. Dimensions shown for "Panel-Type Filters" apply to "Throw away", "Cleanable Wire Mesh", and "High Efficiency Throw away" Filters.
2. S_HF units ordered with "Bag-Type Filters" or "Cartridge Filters" (box-type) include a bank of "Panel-Type Prefilters".
3. The same "Panel-Type Prefilters" are used with "Bag-Type" and "Cartridge (box-type)" filters.

Table 5-5
"Wet Heat" Coil Fin Data

Model	Coil Type	Coil Rows	Total Coil Face Area (sq.ft.)	Fins per Foot	Fins per Foot
SLHF-C20, C25 & C30	WC Prima Flo (hot water)	2	13.75	80	110
SLHF-C40, C50 & C55	WC Prima Flo (hot water)	2	19.25	80	110
SLHF-C60, C70 & C75	WC Prima Flo (hot water)	2	26.25	80	110
SLHG-C90, D11, D12 & D13	WC Prima Flo (hot water)	2	17.5 (2)	80	110
SSHF-C20, C25 & C30	NS (steam)	1	13.75	42	96
SSHF-C40, C50 & C55	NS (steam)	1	13.75 (1) 5.5 (1)	42	96
SSHF-C60, C70 & C75	NS (steam)	1	18.75 (1) 7.5 (1)	42	72
SLHG-C90, D11, D12 & D13	NS (steam)	1	17.5 (2)	52	96

Note: To determine unit heating capacity (i.e., "low heat" or "high heat"), see Digit 9 of the model number stamped on the unit nameplate.

Table 5-6
Grease Recommendations

Recommended Grease	Recommended Operating Range
Exxon Unirex #2	-20 F to 250 F
Mobil 532	
Mobil SHC #220	
Texaco Premium RB	

Table 5-7
Refrigerant Coil Fin Data

Model	Coil Type	Coil Fin Config.	Tube Dia.	Coil Rows	Fins per Foot	Coil Face Area (sq. ft.)	Tube Type
S*HF-C20	Evaporator	wavy-3B	0.5"	2	148	20.30	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	4	148	20.30	I-F
	Condenser	wavy-3B	0.375"	3	156	35.00	smooth
S*HF-C25	Evaporator	wavy-3B	0.5"	2	148	20.30	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	4	148	20.30	I-F
	Condenser	wavy-3B	0.375"	3	156	35.00	smooth
S*HF-C30	Evaporator	wavy-3B	0.5"	3	148	24.40	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	4	148	24.40	I-F
	Condenser	wavy-3B	0.375"	3	168	46.30	smooth
S*HF-C40	Evaporator	wavy-3B	0.5"	2	148	32.50	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	4	148	32.50	I-F
	Condenser	wavy-3B	0.375"	3	168	63.20	smooth
S*HF-C50	Evaporator	wavy-3B	0.5"	3	148	37.90	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	4	148	37.90	I-F
	Condenser	wavy-3B	0.375"	3	168	70.00	smooth
S*HF-C55	Evaporator	wavy-3B	0.5"	3	148	37.90	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	4	148	37.90	I-F
	Condenser	wavy-3B	0.375"	4	144	70.00	smooth
S*HF-C60	Evaporator	wavy-3B	0.5"	2	164	43.10	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	4	148	43.10	I-F
	Condenser	wavy-3B	0.375"	4	168	88.00	smooth
S*HF-C70	Evaporator	wavy-3B	0.5"	3	180	43.10	I-F
	Hi-Cap Evaporator	n/a	n/a	n/a	n/a	n/a	n/a
	Condenser	wavy-3B	0.375"	4	168	88.00	smooth
S*HF-C75	Evaporator	wavy-3B	0.5"	4	148	43.10	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	5	148	43.10	I-F
	Condenser	wavy-3B	0.375"	4	168	88.00	smooth
S*HG-C90	Evaporator	wavy-3B	0.5"	3	148	59.30	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	5	148	59.30	I-F
	Condenser	wavy-3B	0.375"	3	156	152.00	smooth
S*HG-D11	Evaporator	wavy-3B	0.5"	3	180	60.40	I-F
	Hi-Cap Evaporator	wavy-3B	0.5"	5	148	60.40	I-F
	Condenser	wavy-3B	0.375"	4	156	152.00	smooth
S*HG-D12	Evaporator	wavy-3B	0.5"	5	148	60.40	I-F
	Hi-Cap Evaporator	n/a	n/a	n/a	n/a	n/a	n/a
	Condenser	wavy-3B	0.375"	4	156	152.00	smooth
S*HG-D13	Evaporator	wavy-3B	0.5"	5	148	60.40	I-F
	Hi-Cap Evaporator	n/a	n/a	n/a	n/a	n/a	n/a
	Condenser	wavy-3B	0.375"	4	156	152.00	smooth

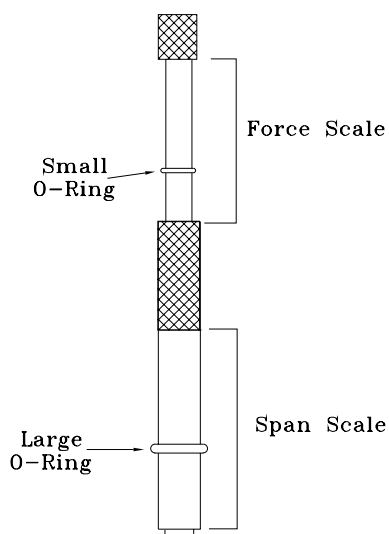
Fan Belt Adjustment

The supply fan belts and optional exhaust fan belts must be inspected periodically to assure proper unit operation.

Replacement is necessary if the belts appear frayed or worn. Units with dual belts require a matched set of belts to ensure equal belt length.

When removing or installing the new belts, do not stretch them over the sheaves. Loosen the belts using the belt tension adjustment bolts on the motor mounting base.

Once the new belts are installed, using a Browning or Gates tension gauge (or equivalent) illustrated below; adjust the belt tension as follows;



WARNING Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

1. To determine the appropriate belt deflection;
 - a. Measure the center-to-center shaft distance (in inches) between the fan and motor sheaves.
 - b. Divide the distance measured in Step 1a by 64; the resulting value represents the amount of belt deflection that corresponds to the proper belt tension.
2. Set the large O-ring on the belt tension gauge at the deflection value determined in Step 1b.
3. Set the small O-ring at zero on the force scale of the gauge plunger.
4. Place the large end of the gauge at the center of the belt span; then depress the gauge plunger until the large O-ring is even with the top of the next belt—or even with a straightedge placed across the fan and motor sheaves. Refer to Figure 5-1
5. Remove the belt tension gauge. The small O-ring now indicates a number other than zero on the plunger's force scale. This number represents the force (in pounds) required to give the needed deflection.
6. Compare the "force" scale reading (Step 5) with the appropriate "force" value listed in Figure 5-1. If the "force" reading is outside the range, readjust the belt tension.

Note: Actual belt deflection "force" must not exceed the maximum "force" value shown in Figure 5-1.

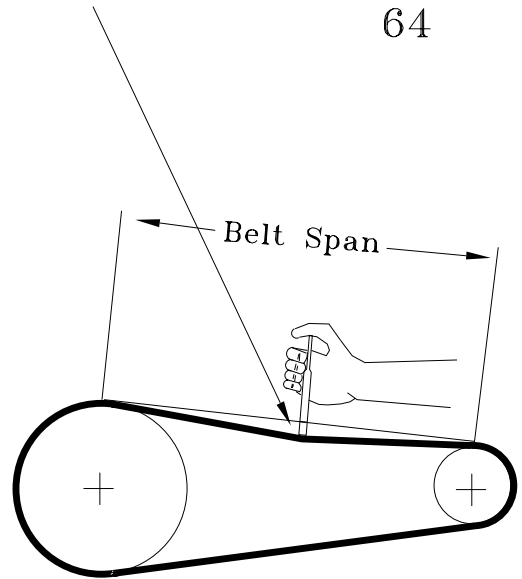
7. Recheck the belt tension at least twice during the first 2 to 3 days of operation. Belt tension will decrease rapidly until the new belts are "run in".

Figure 5-1
Belt Tension Measurement and Deflection Ranges

Belts	Cross Section	Small P.D Range	Deflection Force (Lbs.)				Steel Cable Gripbelts	
			Super Gripbelts		Gripnotch		Min.	Max.
			Min.	Max.	Min.	Max.	Min.	Max.
A		3.0 - 3.6	3	4 1/2	3 7/8	5 1/2	3 1/4	4
		3.8 - 4.8	3 1/2	5	4 1/2	6 1/4	3 3/4	4 3/4
		5.0 - 7.0	4	5 1/2	5	6 7/8	4 1/4	5 1/4
B		3.4 - 4.2	4	5 1/2	5 3/4	8	4 1/2	5 1/2
		4.4 - 5.6	5 1/8	7 1/8	6 1/2	9 1/8	5 3/4	7 1/4
		5.8 - 8.8	6 3/8	8 3/4	7 3/8	10 1/8	7	8 3/4

Belt	Cross Section	Small P.D Range	Deflection Force (Lbs.)			
			358 Gripbelts		358 Gripnotch Belts	
			Min.	Max.	Min.	Max.
5V		4.4 - 8.7	-----	-----	10	15
		7.1 - 10.9	10 1/2	15 3/4	12 7/8	18 3/4
		11.8 - 16.0	13	19 1/2	15	22

$$\text{Deflection} = \frac{\text{Belt Span}}{64}$$



Scroll Compressor Replacement

The compressor manifold system was purposely designed to provide proper oil return to each compressors. The refrigerant manifold system must not be modified in any way.

Note: Altering the compressor manifold piping may cause oil return problems and compressor failure.

Should a compressor replacement become necessary and a suction line filter drier is to be installed, install it a minimum of 18 inches upstream of the oil separator tee. See Figure 5-2.

Anytime a compressor is replaced, the oil for each compressor within the manifolded set must be replaced.

The scroll compressor uses Trane OIL-42 without substitution. The appropriate oil charge for a 9 and 10 Ton scroll compressor is 8.5 pints. For a 14 and 15 Ton scroll compressor, use 13.8 pints.

Note: Do Not release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all Federal, State and local laws. Refer to general service bulletin MSCU-SB-1 (latest edition).

Figure 5-2
Suction Line Filter/Drier Installation

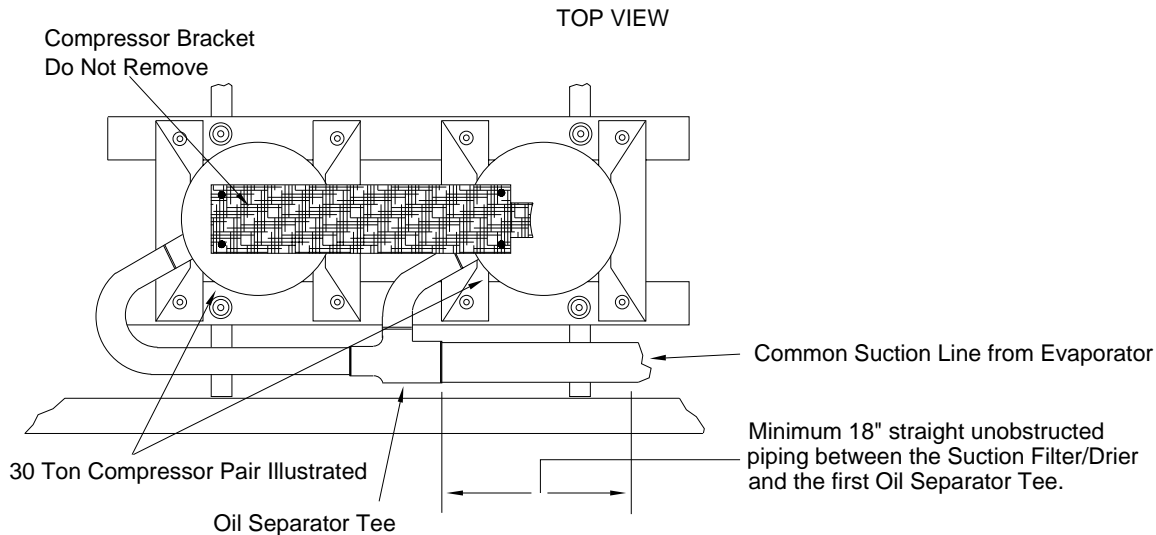


Table 5-8
Supply and Exhaust Fan VFD Programming Parameters

Menu	Parameter	Description	Setting	Description
Load & Motor	102	Motor Power	Set Based on Motor Nameplate	Set only for applications using 3hp Hi-Efficiency motors. Set to 2.2 kW.
	103	Motor Voltage	Set Based on Motor Nameplate	Set only for 200/230v 60hz & 380/415 50hz applications
	105	Motor Current	Set Based on Motor Nameplate	Sets the motor FLA
	106	Motor RPM	Set Based on Motor Nameplate	Sets the motor RPM
Reference & Limits	215	Current Limit	1 x Rated Current	Limits the maximum current to motor

* These parameters are motor specific and the actual motor nameplate rating must be used. Do not use the unit name plate values.



WARNING

Hazardous Voltage! w/Capacitors!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

Note: For additional information regarding the safe discharge of capacitors, see *PROD-SVB06A-EN*

VFD Programming Parameters

Units shipped with an optional variable frequency drive (VFD) are preset and run tested at the factory. If a problem with a VFD occurs, ensure that the programmed parameters listed in Table 5-8 have been set before replacing the drive.

Note: Check to make sure that parameter 104 is set to 60 Hz. To check parameter 104 press the Extended Menu button, press the Left Arrow button until menu Load & Motor is shown, press the up arrow until parameter 104 is displayed. Parameter 104 can then be modified by pressing the Change Data button and then the Up Arrow button. When the desired selection has been made press the OK button.

Should replacing the a VFD become necessary, the replacement is not configured with all of Trane's operating parameters. The VFD must be programmed before attempting to operate the unit.

To verify and/or program a VFD, use the following steps:

1. At the unit, turn the 115 volt control circuit switch 1S70 to the "Off" position.
2. Turn the 24 volt control circuit switch to the "Off" position.



WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

HIGH VOLTAGE IS PRESENT AT TERMINAL BLOCK 1TB1 OR UNIT DISCONNECT SWITCH 1S14.

3. To modify parameters:
 - (a) Press the Extended Menu button
 - (b) Press the Left or Right Arrow button to scroll through menus
 - (c) Press the up or down arrow to scroll through parameter settings within a specified menu
 - (d) Press the Change Data button to allow a parameter value to be changed
 - (e) Press the Up or Down arrow button to change the parameter
 - (f) Press OK button when desired change has been made.
4. Repeat step (3) for each menu selection setting in Table 5-8.
5. To reset all programming parameters back to the factory defaults:
 - (g) Press the Extended Menu button
 - (h) Press the Left or Right Arrow button to scroll to the KEYB. & DISPLAY menu.
 - (i) Press the Down Arrow button to scroll to the Active Setup menu.
 - (j) Press the Change Data button.
 - (k) Press the Up Arrow button to scroll to the Factory Default setting.
 - (l) Press the OK button.
 - (m) Press the Up Arrow button to scroll to the Setup Copy menu.
 - (n) Press the Change Data button.
 - (o) Press the Up Arrow button to scroll to the Copy to Setup 1 setting.
 - (p) Press the OK button.

- (q) Press the Up Arrow button to scroll to the Active Setup menu.
- (r) Press the Change Data button.
- (s) Press the Up Arrow button to scroll to the Setup 1 setting.
- (t) Press the OK button.
- (v) Press the Change Data button.
- (w) Press the Up Arrow button to scroll to the Down load All Parameters setting.
- (x) Press the OK button

Note: Item 5 resets the drive to the default factory settings. The program parameters listed in Table 5-8 will need to be verified or changed as described in Item 3 and 4.

Note: Some of the parameters listed in the Table are motor specific. Due to various motors and efficiencies available, use only the values stamped on the specific motor nameplate. Do not use the Unit nameplate values.

- 6. Follow the start-up procedures for supply fan in the "Variable Air Volume System" section or the "Exhaust Airflow Measurement" start-up procedures for the exhaust fan.
- 7. After verifying that the VFD(s) are operating properly, press the STOP key at the Human Interface Module to stop the unit operation.
- 8. Follow the applicable steps in the "Final Unit Checkout" section to return the unit to its normal operating mode.

Service & Maintenance (Continued)

Monthly Maintenance

Before completing the following checks, turn the unit OFF and lock the main power disconnect switch open.



WARNING Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Filters

- [] Inspect the return air filters. Clean or replace them if necessary. Refer to the Table 5-4 for filter information.

Cooling Season

- [] Check the unit's drain pans and condensate piping to ensure that there are no blockages.
- [] Inspect the evaporator and condenser coils for dirt, bent fins, etc. If the coils appear dirty, clean them according to the instructions described in "Coil Cleaning" later in this section.
- [] Manually rotate the condenser fans to ensure free movement and check motor bearings for wear. Verify that all of the fan mounting hardware is tight.
- [] Inspect the F/A-R/A damper hinges and pins to ensure that all moving parts are securely mounted. Keep the blades clean as necessary.
- [] Verify that all damper linkages move freely; lubricate with white grease, if necessary.
- [] Check supply fan motor bearings; repair or replace the motor as necessary.
- [] Check the fan shaft bearings for wear. Replace the bearings as necessary.
- [] Lubricate the supply fan bearings with a lithium based grease. Refer to Table 5-6 for recommended greases.

Note: The bearings are manufactured using a special synthetic lithium based grease designed for long life and minimum lube intervals. Over lubrication can be just as harmful as not enough.

Use a hand grease gun to lubricate these bearings; add grease until a light bead appears all around the seal. Do not over lubricate!

After greasing the bearings, check the setscrews to ensure that the shaft is held securely to the bearings and fan wheels. Make sure that all bearing supports are tight.

- [] Check the supply fan belt(s). If the belts are frayed or worn, replace them. Refer to the "Fan Belt Adjustment" section for belt replacement and adjustments.

- [] Check the condition of the gasket around the control panel doors. These gaskets must fit correctly and be in good condition to prevent water leakage.
- [] Verify that all wire terminal connections are tight.
- [] Remove any corrosion present on the exterior surfaces of the unit and repaint these areas.
- [] Generally inspect the unit for unusual conditions (e.g., loose access panels, leaking piping connections, etc.)
- [] Make sure that all retaining screws are reinstalled in the unit access panels once these checks are complete.
- [] With the unit running, check and record the:

ambient temperature;
 compressor oil level (each circuit);
 compressor suction and discharge pressures (each circuit);
 superheat and subcooling (each circuit);

Record this data on an "operator's maintenance log" like the one shown in Table 5-8. If the operating pressures indicate a refrigerant shortage, measure the system superheat and system subcooling. For guidelines, refer to "Charging by Subcooling".

Note: Do Not release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all federal, state and local laws. Refer to general service bulletin MSCU-SB-1 (latest edition).

Heating Season

Before completing the following checks, turn the unit OFF and lock the main power disconnect switch open.

WARNING **Hazardous Voltage!**

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

- [] Inspect the unit's air filters. If necessary, clean or replace them.
- [] Check supply fan motor bearings; repair or replace the motor as necessary.
- [] Lubricate the supply fan bearings with a lithium based grease. Refer to Table 5-6 for recommended greases.

Note: The bearings are manufactured using a special synthetic lithium based grease designed for long life and minimum lube intervals. Too much lubrication in a bearing can be just as harmful as not enough.

Use a hand grease gun to lubricate the bearings; add grease until a light bead appears all around the seal. Do not over lubricate!

Service & Maintenance (Continued)

After greasing the bearings, check the setscrews to ensure that the shaft is held securely. Make sure that all bearing braces are tight.

- [] Inspect both the main unit control panel and heat section control box for loose electrical components and terminal connections, as well as damaged wire insulation. Make any necessary repairs.
- [] Gas Heat Units only - Check the heat exchanger for any corrosion, cracks, or holes.
- [] Check the combustion air blower for dirt. Clean as necessary.

Note: Typically, it is not necessary to clean the gas furnace. However, if cleaning does become necessary, remove the burner inspection plate from the rear of the heat exchanger to access the drum. Be sure to replace the existing gaskets with new ones before reinstalling the inspection plate.

- [] Open the main gas valve and apply power to the unit heating section; then initiate a "Heat" test using the start-up procedure described in "Gas Furnace Start-Up".



WARNING **Hazardous Gases and Flammable Vapors!**

Exposure to hazardous gases from fuel substances have been shown to cause cancer, birth defects or other reproductive harm. Improper installation, adjustment, alteration, service or use of this product could cause flammable mixtures. To avoid hazardous gases and flammable vapors follow proper installation and set up of this product and all warnings as provided in this manual. Failure to follow all instructions could result in death or serious injury.

When using dry nitrogen cylinders for pressurizing units for leak testing, always provide a pressure regulator on the cylinder to prevent excessively high unit pressures. Never pressurize unit above the maximum recommended unit test pressure as specified in applicable unit literature. Failure to properly regulate pressure could result in a violent explosion, which could result in death or serious injury or equipment or property-only-damage.

- [] Verify that the ignition system operates properly.

Coil Cleaning

Regular coil maintenance, including annual cleaning—enhances the unit's operating efficiency by minimizing:

compressor head pressure and amperage draw;
 water carryover;
 fan brake horsepower; and,
 static pressure losses.

At least once each year—or more often if the unit is located in a "dirty" environment—clean the evaporator and condenser coils using the instructions outlined below. Be sure to follow these instructions as closely as possible to avoid damaging the coils.

CAUTION

Coil Cleaners!

Coil cleaners can damage roofs, surrounding buildings, vehicles, etc. Cleaning substances should be checked to ensure that they will not cause damage to surroundings. Coils and roof (if applicable) should be rinsed thoroughly. Do not spray coil cleaners in windy conditions.

Refrigerant Coils

To clean refrigerant coils, use a soft brush and a sprayer (either a garden pump-up type or a high-pressure sprayer). A high-quality detergent is also required; suggested brands include "SPREX A.C.", "OAKITE 161", "OAKITE 166" and "COILOX". If the detergent selected is strongly alkaline (pH value exceeds 8.5), add an inhibitor.

1. Remove the access panels on both sides of the unit and the filters.



WARNING No Step Surface!

Do not walk on the sheet metal drain pan. Walking on the drain pan could cause the supporting metal to collapse. Failure of the drain pan could result in death or serious injury.

Note: Bridging between the unit's main supports may consist of multiple 2 by 12 boards or sheet metal grating.

2. Straighten any bent coil fins with a fin comb. (Use the data in Table 5-7 to determine the appropriate fin comb size.)
3. Mix the detergent with water according to the manufacturer's instructions. If desired, heat the solution to 150 F maximum to improve its cleansing capability.



WARNING Contains Refrigerant!

System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives. Failure to follow proper procedures or the use of non-approved refrigerants, refrigerant substitutes, or refrigerant additives could result in death or serious injury or equipment damage.

6. Rinse both sides of the coil with cool, clean water.
7. Inspect both sides of the coil; if it still appears to be dirty, repeat Steps 7 and 8.
8. Reinstall all of the components and panels removed in Step 2; then restore power to the unit.

Note: Refrigerant oil is detrimental to some roofing materials. Care must be taken to protect the roof from oil leaks or spills.

4. Pour the cleaning solution into the sprayer. If a high-pressure sprayer is used:
 - a. Do not allow the sprayer pressure to exceed 600 psi. The minimum spray nozzle angle is 15 degrees.
 - b. Spray the solution perpendicular (at 90 degrees) to the coil face.
 - c. Maintain a minimum clearance of 6" between the sprayer nozzle and the coil.
5. Spray the leaving-airflow side of the coil first; then spray the opposite side of the coil. Allow the cleaning solution to stand on the coil for five minutes.
6. Rinse both sides of the coil with cool, clean water.
7. Inspect both sides of the coil; if it still appears to be dirty, repeat Steps 7 and 8.
8. Reinstall all of the components and panels removed in Step 2; then restore power to the unit.

Steam or Hot Water Coils

To clean a steam or hot water coil, use a soft brush, a steam-cleaning machine, and water.

1. Verify that switches 1S1 and 1S70 are turned "OFF", and that the main unit disconnect is locked open.
2. Remove enough panels and components from the unit to gain sufficient access to the coil.
3. Straighten any bent coil fins with a fin comb. (Use the data in Table 5-5 to determine the appropriate fin comb size.)
4. Remove loose dirt and debris from both sides of the coil with a soft brush.
5. Use the steam-cleaning machine to clean the leaving-air side of the coil first; start at the top of the coil and work downward; then clean the entering-air side of the coil, starting at the top of the coil and working downward.
6. Check both sides of the coil; if it still appears dirty, repeat Step 5.
7. Reinstall all of the components and panels removed in Step 2; then restore power to the unit.

Service & Maintenance (Continued)

Final Process

For future reference, you may find it helpful to record the unit data in the blanks provided.

Complete Unit Model Number: _____

Unit Serial Number: _____

Unit "DL" Number ("Design special" units only): _____

Wiring Diagram Numbers (from unit control panel):
—schematic(s)

—connections

Unit Address (TCI) _____

Network ID (LCI) _____

Table 5-8 Sample Operator's Maintenance Log (See Note)

Date	Refrigerant Circuit #1							Refrigerant Circuit #2					
	Current Ambient Temp. (F)	Compr. Oil Level	Suct. Press. (Psig)	Disch. Press. (Psig)	Liquid Press. (Psig)	Super-heat (F)	Sub-cool. (F)	Compr. Oil Level	Suct. Press. (Psig)	Disch. Press. (Psig)	Liquid Press. (Psig)	Super-heat (F)	Sub-cool. (F)
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					

Note: Check and record the data requested above each month during the cooling season with the unit running.

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WARRANTY AND LIABILITY CLAUSE

COMMERCIAL EQUIPMENT RATED 20 TONS AND LARGER AND RELATED ACCESSORIES

PRODUCTS COVERED - This warranty* is extended by American Standard Inc. and applies only to commercial equipment rated 20 Tons and larger and related accessories.

The Company warrants for a period of 12 months from initial start-up or 18 months from date of shipment, whichever is less, that the Company products covered by this order (1) are free from defects in material and workmanship and (2) have the capacities and ratings set forth in the Company's catalogs and bulletins, provided that no warranty is made against corrosion, erosion or deterioration. The Company's obligations and liabilities under this warranty are limited to furnishing f.o.b. factory or warehouse at Company designated shipping point, freight allowed to Buyer's city (or port of export for shipment outside the continental United States) replacement equipment (or at the option of the Company parts therefore) for all Company products not conforming to this warranty and which have been returned to the manufacturer. The Company shall not be obligated to pay for the cost of lost refrigerant. No liability whatever shall attach to the Company until said products have been paid for and then said liability shall be limited to the purchase price of the equipment shown to be defective.

The Company makes certain further warranty protection available on an optional extra-cost basis. Any further warranty must be in writing, signed by an officer of the Company.

The warranty and liability set forth herein are in lieu of all other warranties and liabilities, whether in contract or in negligence, express or implied, in law or in fact, including implied warranties of merchantability and fitness for particular use. In no event shall the Company be liable for any incidental or consequential damages.

THE WARRANTY AND LIABILITY SET FORTH HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESS OR IMPLIED, IN LAW OR IN FACT, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR USE, IN NO EVENT SHALL WARRANTOR BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Manager - Product Service
American Standard Inc.
Clarksville, Tn 37040-1008

PW-215-2688

*A 10 year limited warranty is provided on optional Full Modulation Gas Heat Exchanger.

*Optional Extended Warranties are available for compressors and heat exchangers of Combination Gas-Electric Air Conditioning Units.



CAUTION **Equipment Damage From Ultraviolet** **(UV) Lights!**

Trane does not recommend field installation of ultraviolet lights in its equipment for the intended purpose of improving indoor air quality. High intensity C-band ultraviolet light is known to severely damage polymer (plastic) materials and poses a personal safety risk to anyone exposed to the light without proper personal protective equipment. Polymer materials commonly found in HVAC equipment that may be susceptible include insulation on electrical wiring, fan belts, thermal insulation, various fasteners and bushings. Degradation of these materials can result in serious damage to the equipment.

Trane accepts no responsibility for the performance or operation of our equipment in which ultraviolet devices were installed outside of the Trane factory or its approved suppliers.

